LIBRARY

23

JAN 6 1936

Vol. 33, No. 1 PSYCHOLOGICAL REVIEW PUBLICATIONS January, 1936

Psychological Bulletin

EDITED BY

JOHN A. McGEOCH, WESLEYAN UNIVERSITY

SAMUEL W. FERNBERGER, UNIV. OF PENNSYLVANIA *(J. Exper. Psychol.)*
WALTER S. HUNTER, CLARK UNIVERSITY *(Psychol. Index)*
HERBERT S. LANGFELD, PRINCETON UNIV. *(Psychol. Rev.)*
JOHN F. DASHIELL, UNIV. OF NORTH CAROLINA *(Psychol. Monog.)*

WITH THE CO-OPERATION OF

G. W. ALLPORT, HARVARD UNIVERSITY; J. E. ANDERSON, UNIVERSITY OF MINNESOTA; W. T. HERON, UNIVERSITY OF MINNESOTA; J. T. METCALF, UNIVERSITY OF VERMONT; R. PINTNER, COLUMBIA UNIVERSITY.

CONTENTS

General Review and Summary:
Psychological Experiments with Disordered Persons: J. McV. HUNT, 1.

Special Review: Koffka's Principles of Gestalt Psychology: EDWIN G. BORING, 59.

Books Received: 70.

PUBLISHED MONTHLY (EXCEPT AUGUST AND SEPTEMBER)
FOR THE AMERICAN PSYCHOLOGICAL ASSOCIATION
BY THE PSYCHOLOGICAL REVIEW COMPANY
PRINCETON, N. J.

Entered as second-class matter at the post-office at Princeton, N. J., with an additional entry at Albany, N. Y.

Publications of the American Psychological Association

EDITED BY

S. W. FERNBERGER, University of Pennsylvania (*J. Exper. Psychol.*)
WALTER S. HUNTER, Clark University (*Index and Abstracts*)
HENRY T. MOORE, Skidmore College (*J. Abn. and Soc. Psychol.*)
HERBERT S. LANGFELD, Princeton University (*Review*)
JOHN A. McGEOCH, Wesleyan University (*Bulletin*)
JOHN F. DASHIELL, University of North Carolina (*Monographs*)

HERBERT S. LANGFELD, Business Editor

PSYCHOLOGICAL REVIEW

containing original contributions only, appears bi-monthly, January, March, May, July, September, and November, the six numbers comprising a volume of about 540 pages.

PSYCHOLOGICAL BULLETIN

containing critical reviews of books and articles, psychological news and notes, university notices, and announcements, appears monthly (10 numbers), the annual volume comprising about 720 pages. Special issues of the Bulletin consist of general reviews of recent work in some department of psychology.

JOURNAL OF EXPERIMENTAL PSYCHOLOGY

containing original contributions of an experimental character, appears bi-monthly, February, April, June, August, October, and December, the six numbers comprising a volume of about 900 pages.

PSYCHOLOGICAL INDEX

is a compendious bibliography of books, monographs, and articles upon psychological and cognate topics that have appeared during the year. The Index is issued annually in June, and may be subscribed for in connection with the periodicals above, or purchased separately.

PSYCHOLOGICAL ABSTRACTS

appears monthly, the twelve numbers and an index supplement making a volume of about 700 pages. The journal is devoted to the publication of non-critical abstracts of the world's literature in psychology and closely related subjects.

PSYCHOLOGICAL MONOGRAPHS

consist of longer researches or treatises or collections of laboratory studies which it is important to publish promptly and as units. The price of single numbers varies according to their size. The Monographs appear at irregular intervals and are gathered into volumes of about 500 pages.

JOURNAL OF ABNORMAL AND SOCIAL PSYCHOLOGY

appears quarterly, June, September, December, March, the four numbers comprising a volume of 448 pages. The journal contains original contributions in the field of abnormal and social psychology, reviews, notes and news.

ANNUAL SUBSCRIPTION RATES

Review: $5.50 (Foreign, $5.75). Index: $4.00 per volume.
Journal: $7.00 (Foreign, $7.25). Monographs: $6.00 per volume (Foreign, $6.30).
Bulletin: $6.00 (Foreign, $6.25). Abstracts: $6.00 (Foreign, $6.25).
Abnormal and Social: $5.00 (Foreign, $5.25). Single copies $1.50.
Current numbers: Journal, $1.25; Review, $1.00; Abstracts, 75c; Bulletin, 60c.

COMBINATION RATES

Review and Bulletin: $10.00 (Foreign, $10.50).
Review and J. Exper.: $11.00 (Foreign, $11.50).
Bulletin and J. Exper.: $12.00 (Foreign, $12.50).
Review, Bulletin, and J. Exper.: $16.00 (Foreign, $16.75).
Review, Bulletin, J. Exper., and Index: $19.00 (Foreign $19.75).

Subscriptions, orders, and business communications should be sent to the

PSYCHOLOGICAL REVIEW COMPANY

PRINCETON, N. J.

Vol. 33, No. 1 January, 1936

THE
PSYCHOLOGICAL BULLETIN

PSYCHOLOGICAL EXPERIMENTS WITH DISORDERED PERSONS

BY J. McV. HUNT *
University of Nebraska

In a recent examination of the status of the psychology of the abnormal, W. A. Hunt and C. Landis have pointed out that one of the glaring deficiencies in the textbooks of this subject and of psychiatry is the omission of the available experimental results.[1] In view of the possibility that this omission may be partially due to the fact that these results have never been collected and made available in one place, we have undertaken this review.[2] While there is no logical excuse to divide the experimental work in this field on lines of language, the volume of the material and the fact that only the English titles have been examined in any degree of comprehensiveness by the writer at the present has led to this kind of presentation. Thus, although incomplete, this review is a beginning of a collection of the available experimental knowledge of psychotic patients, and the

* This study was prepared for publication while the writer was a National Research Council Fellow in Psychology.

[1] Hunt, W. A., and Landis, C., The Present Status of Abnormal Psychology. *Psychol. Rev.*, 1935, **42**, 78–90.

[2] Brief reviews of experimental work in the psychology of the disorders have been published by Wells (**192, 193**) and by Hoch (**81**).

The writer expresses his gratitude to Professor Bentley who suggested this project and who gives a brief summary of the methods in *The Problem of Mental Disorder*. New York: McGraw-Hill Book Co., 1935. *Cf.* Chapter XV: "General and Experimental Psychology", pp. 275–308. The project was begun at Cornell University and carried to completion while the writer was associated with New York Psychiatric Institute and Hospital and with Worcester State Hospital. He wishes to express his appreciation of the privileges granted him by both institutions.

writer hopes to present the work published in other languages in the not too distant future.

In defining the limits of our inquiry, we exclude the topics of sleep, dreams, hypnosis, and amentia. To be set forth here are the experimental, psychological investigations of the mentally disordered. While there are undoubtedly omissions, an attempt has been made to collect the English titles through 1934.

To be truly experimental an investigation should attempt an adequate description of some psychological aspect of disordered persons from direct observation. The factors in question should be isolated, so far as possible, by adequate control of the conditions. The observations under one set of conditions should be checked with those obtained under variations of those conditions, and the procedures should be repeated a sufficient number of times to determine at least the statistical accuracy of the results. These results should also be set forth in stated relation to other experimental investigations and systematically oriented in the subject. In applying our standards to the material of this inquiry, however, we have been guided by the feasible as well as the ideal. We include much that lies on the border of experimental psychology.

The rubrics under which the various investigations are presented were chosen with the standpoint of the individual investigator in view. The systematic views of the writer have also been a determining factor. The wide divergence of aim among the investigators has necessitated some arbitrariness, but it is hoped that some order has been made of what at first appeared chaos.

I. Investigations of Psychological Efficiency and Capacity.

A. *General Intellectual Efficiency and Capacity (Psychometric Tests).* A decrease in intellectual efficiency has long been considered obvious in those suffering from mental disorder. It was quite natural, with the development of the tests of intelligence, that these instruments should be employed to measure these losses of efficiency, more commonly called 'deterioration'.

Hart and Spearman (75) describe one of the earliest attempts to measure deterioration by the method of test. Using, not the standard scales, but a series of various types of tasks including simple sensory discriminations, motor and memorial tests, and some requiring more complex functions, they found no clear distinction between psychotics and normal persons except one of gross scores. The psychotics made the same types of errors and exhibited the same types of inability as did the non-psychotics. In gross scores, however, the 14

poorest of the normal group were approximately equal to the 14 best of the psychotic group. Hart and Spearman recognized the need for some statement of the patient's original efficiency or capacity before it would be possible to measure the extent of loss. They concluded that "dementia" did not consist in losses within specific faculties but was generalized. Thus, they considered their results a confirmation of Spearman's two-factor theory.

Several investigators have employed the standardized scales to compare the intellectual status of patients of various diagnoses. They have attempted to determine roughly the extent of deterioration by comparing the scores obtained from patients with test-norms, or with scores obtained from matched groups of non-psychotic individuals, and also by comparing the scores with the patients' educational and occupational history.

Wells and Kelley (196) found, from an examination with the Stanford-Binet scale of 102 cases newly admitted to McLean Hospital, that the I.Q.'s were lowest among the 'organic' cases (paresis and psychoses resulting from arteriosclerosis). In cases of dementia praecox and manic-depressive insanity a reduction was frequently not evident. Rawlings (145) tested 50 cases of paranoid schizophrenia with a battery of scales including the Yerkes-Bridges Point Scale, the Kent-Rosanoff association list, the Woodworth and Wells genus species test, and a test of information. The average I.Q. of the patients was only 72.

Cornell and Lowden (36) compared results obtained with the Stanford-Binet scale and the Porteus maze-tests from 50 cases each of dementia praecox, constitutional psychopathic inferiority, and feeblemindedness, and from 24 normal persons. The 2 tests correlated poorly for all abnormal subjects, suggesting to these writers that something other than mental age was operative. Since the degree of failure on the Porteus was greatest for those patients considered least abnormal, Cornell and Lowden took issue with Porteus on the theory that his test would measure temperamental factors. G. Barnes (11) found results on the Stanford-Binet scale from manic-depressive and from dementia praecox patients so similar that she concluded the test was useless as a tool for giving information about what is happening within a disordered person—a purpose for which the tests were not devised. Dearborn (41) reported results indicating a "degenerative mental process" going on in patients who have suffered from several manic-depressive episodes.

Schott (157) has reported results obtained with the Stanford-Binet scale from 450 patients at the Henry Ford Hospital in Detroit. The median I.Q. for the whole group, including all forms of disorder, was 92.4. Eighteen cases had I.Q.'s over 120. Although in earlier tests on individuals in this group with

superior intelligence where available, all showed I.Q.'s above 140, Schott argued that his results were still not indicative of loss, for all these "superior patients" were above the level demanded by Terman's tests when they were tested at the hospital.

Hollingworth (82) and Tendler (176) both report that the various types of psychoneurotics are distinguished by differences in mental age. The average mental age for Tendler's neurasthenics was 10.7 years, for his psychasthenic group, 12 years, and for his hysterical patients, 13.6 years. Hollingworth has drawn important theoretical implications from these findings, namely, that the patient's intellectual stature tends to determine the form of his symptomatology. As the differences in mental age are only slight differences between the means of the various groups, Hollingworth's theoretical conclusions are probably not well founded.

The effects of idiopathic epilepsy upon intelligence have also been investigated by several persons who employed the tests. Richmond (146) found both slight and great deterioration, as exhibited by the mental age, in a small group of epileptic patients. Fetterman and Barnes (53) obtained an average I.Q. of 74 for a group of 105 chronic epileptics tested with the Stanford-Binet. Retests of 46 patients after intervals of from 1 to 2 years, however, showed no statistically significant loss.

Berrien (18) has attempted to distinguish psychopathic and post-encephalitic children by means of a battery of tests. Post-encephalitic children rated consistently below the average in all tests while psychopathic children tended to 'scatter'. Four tests in the Kuhlman-Anderson series seemed to distinguish between the 2 groups. Brown (30) has made 2 or more repeated tests on a group of 83 post-encephalitic children with the Stanford-Binet scale, a test of motor coördination, and the Woodworth-Mathews personal data sheet. A marked downward trend in I.Q. appeared in most of those exhibiting Parkinsonian symptoms, but slight if any downward trend was evident in the non-Parkinsonian cases. The test of motor coördination differentiated best between normal and post-encephalitic children. With the personal-data sheet a small but significant difference was found which was actually in favor of the encephalitic children.

1. *'Scatter'.* Investigators employing the tests of intelligence with psychotic persons soon noted from a rough analysis of the performances that the 'failures' and 'passes' of psychotic patients were scattered over more year-levels than were those of non-psychotic persons. This phenomenon was reported by Binet and Simon (20) in their book on the intelligence of the feebleminded. Yerkes (208) also reported it in the results from psychotic patients on his own "Point Scale Examination". S. L. Pressey (136), employing the Yerkes scale with dementia praecox and chronic alcoholic patients, got a hint that the breadth of the 'scatter' was related to the amount of loss a patient had suffered, when he related it to the evidences of pre-psychotic capacity as obtained from histories. He found failures

and successes appearing simultaneously in 2 more year-levels in the performances of psychotic patients than in the performances of feeble-minded subjects matched with the psychotics for mental age. Pressey and Cole (**138**) then devised a scheme of weighting failures and passes according to their distance in year-levels from the subject's mental age, thus providing a quantitative index of 'scatter'. With this tool they again found psychotic patients exhibiting a higher 'scatter score' than did defectives. They concluded that "more than 21 points of irregularity" was indicative of interference from the psychosis, but that it need not mean actual deterioration or loss of capacity. Pressey (137) later considered 'scatter' to be an index of the reliability of the obtained mental age—the wider the 'scatter' the lower the reliability.

Curtis (**37**) and Wells and Kelley (**196**) have also found these extremes of irregularity in the performance of psychotic patients on the standard tests of intelligence. Wells and Kelley found the widest scatter among patients with organic involvement, paresis and arteriosclerosis. On the basis of these results and others presented in his book on mental tests in clinical practice, Wells (**190**) suggested that an adult scattering over 5 or more year-levels might fairly raise the question of organic or toxic involvement.

Not all of the results from investigations of 'scatter', however, have been consistent with these just mentioned. Testing 200 cases of dementia praecox with the Stanford-Binet scale, Wentworth (**200**) found 3 groups: (1) those whose performance was consistently poor in all tests, (2) those who exhibited blocking which resulted in responses of uneven quality and accuracy, yielding the phenomenon of 'scatter', and (3) those who performed without apparent interference. Abnormal scatter characterized the performances of only about half of the patients. Wentworth concluded that there was little relation between width of scatter and amount of deterioration, for, as she believed, the first group had deteriorated most.

Sims (**162**) compared the variability of psychopathic patients and that of normal children on successive tests to find it no greater among the patients than among the children. Although variability on successive tests is not equivalent to scatter, Sims appears to have equated the two effects. He objected to their being used as indications of disorder. Although Wallin (**183**) found, from an analysis of the test results from 1,025 cases who passed through his clinic, that psychotic subjects tended to have a wider scatter than feebleminded or normal children, he objected to scatter as a "pathognomonic sign of psychopathy". He founded his objection upon the fact that statistical tendencies do not take account of the circumstances in a single case.

2. Types of Inefficiency or Loss. While the phenomenon of 'scatter' may have a certain value in clinical work, it yields very little information about the types of inefficiency occurring in the psychoses. Several investigators have employed the tests for this purpose.

Wentworth (**200**), in the study already mentioned, found that tests which she believed involved "ideational judgment" and the ability to generalize (interpreting fables) offered the greatest difficulty for schizophrenic patients. Richmond (**146**) found epileptics poor in tests involving motor coördination. They also had abnormal difficulty in following directions, frequently losing part of the *Aufgabe*. From an analysis of the successes and failures of 16 well-preserved cases of paranoid schizophrenia on a battery of tests Rawlings (**145**) found the scores on information-tests relatively low. Memories were "patchy". Linguistic fluency appeared to suffer, and the patients exhibited a tendency to deal more effectively with the concrete than the abstract.

A more specific and careful analysis of successes and failures on the Stanford-Binet scale is to be found in the study by Wells and Kelley (**196**) already mentioned. Briefly summarizing:

The tests near the limiting year-levels passed most frequently by psychotic patients are comprehension (VIII–3), total value of stamps (IX–a″), the vocabulary tests, comprehension 4th degree (X–5), making change (IX–3), the Healy A (X–a3), abstract words (never passed by feebleminded subjects) (XII–2), and dissected sentences (XII–4). Those tests most frequently failed were: serial weights (IX–2), rhymes (IX–6), enclosed boxes (XVI–4), designs (X–3), reading to report (X–4), ball and field—superior plan (XII–3), and the interpretation of fables (X–5 and XII–5). Wells and Kelley emphasized the necessity for and the difficulty of obtaining coöperation. They also suggested that the tests of intelligence be employed to show progressive loss or recovery of function, a use common in clinical practice today.

In an attempt to lay down rules for the use of tests in the investigation of the loss or recovery of function, Dearborn (**40**) states that a change of more than 9 months in mental age on successive tests has significance. He has summarized the "constituents of intellectual regression" as: "(1) lowering of the power of voluntary attention, (2) virtual or real lessening of the power of memory, (3) derangements of conceptual association and perception, and (4) a tendency to mental evasion". An attempt to summarize the types of psychological loss involved in the psychoses is almost unique, but the value of this one is limited by the undemonstrable assumption that certain powers are reduced and by the fact that Dearborn gives his readers none of the data from which he draws his conclusions. Dearborn,

too, found that psychotic patients do about their best work on vocabulary tests.

3. *Measures of the Amount of Loss.* After several investigators, as we have mentioned, had found the vocabulary of psychotic patients practically intact even though their efficiency on other tasks was considerably reduced, Babcock (**4**) was led to the ingenious use of the vocabulary test as a measure of pre-psychotic capacity, using it as a reference point in measuring deterioration.

Her battery of tests, not all fortunately chosen, consisted of 30 aimed at measuring the speed of several types of performances and the efficiency of "the fixation phase of memory". Babcock standardized her test with 264 controls (people who carry on in society) whose mental age varied from 5 to 20 years, as determined by the Stanford, Otis, or Thurstone scales. Norms were obtained by relating the scores of the controls on her efficiency tests to their scores made on the vocabulary test. An index of efficiency (the measure of deterioration) is obtained as the discrepancy between a patient's actual score on the efficiency tests and what that score should be from his score on the vocabulary test.

Babcock (**4**) first employed her test to measure the deterioration in a group of 75 paretic patients, comparing them with 164 normal persons. The median index of efficiency for the normal subjects was +0.1, for the paretic group —4.8. A significant difference in the median index of efficiency was also found for improving and non-improving paretics. Babcock (**6**) has since described a study of 124 coöperative schizophrenic patients. Although this study may be criticized from several standpoints which cannot be mentioned in this review, it is the best of its kind available at the present time. Suffice it to say that when the vocabulary of the patients was taken as a reference point for native capacity, some loss was almost always demonstrable. While the range of the indices of efficiency for the normal group of 228 subjects was from —3.4 to +3.2, median of +0.05, that of the schizophrenic patients was —13.1 to +0.5 with a median of —3.5. Babcock describes the loss in the early stages of schizophrenia as a "retardation of associations" with a "marked learning defect" which she believes is probably secondary to the retardation. She has found a "defect in the ability to fixate and recall new data". The school histories of her patients indicated impairment at an early age. A positive relationship existed between efficiency and the ability to adjust. Characteristic differences appeared between the sub-groups.

Schwarz (**158**) gave the Babcock test to 110 dementia praecox patients and obtained results similar to Babcock's. Length of hospitalization correlated posi-

tively with the amount of deterioration. Wittman (205) tested 245 patients at Elgin State Hospital and found the lowest average indices of efficiency for patients with "organic involvement" (epileptics —5.4, paretics —5.1, arteriosclerotics —4.9). The indices were highest for psychoneurotics (—0.6), and only slightly lower for schizophrenia (—0.8) and for manic-depressive insanity (—1.4). Wittman also retested 39 paretics after therapy and found their scores positively correlated with judgments independently arrived at by psychiatrists. Some exhibited definite improvement.

Simmins (163) has used Babcock's method (not her test) to determine the loss of "g-ability" in 200 psychotic patients in England. For comparison with the test of vocabulary, Simmins employed a battery of Spearman's "visual-perception-tests", considered to be measures of 'g'. Scores in the vocabulary test yielded a bell-shaped distribution about a mean similar to that for non-psychotic adults. No evidence of "g-deterioration" was observed in patients about to be discharged as "recovered", nor in 21 cases of hysteria, nor in 2 cases of puerperal insanity. The greatest losses of 'g' were found again among patients with 'organic' involvement.

4. *Qualitative Observations.* Several other studies, aimed at describing what may be gleaned from the administration of the tests of intelligence for clinical practice, should be mentioned.

Wires (204) has described a method of evaluating the disordered subject's mode of manipulating the objects in the formboards of the Pintner-Patterson scale. Piotrowski (132), in turn, found that though schizophrenic children and defectives might make the same inferior scores on the tests, their methods of handling the material were different. Schizophrenic children repeated their errors less frequently; they perceived the unfitness of a piece more quickly, and did not touch pieces already correctly placed. Piotrowski (133) has also shown that schizophrenic children earn better scores on verbal tests, whereas defectives do relatively better with performance tests. Another interesting finding by Piotrowski, one which deserves further investigation, is the failure of schizophrenic children to react to urging or praise. Defectives do quite the contrary.

5. *Summary and Criticism.* As a tool for psychological research the tests of intelligence are exceedingly blunt. Growing out of the vague concept of intelligence, the significance of the separate tasks which compose the test was never worked out. The concepts of I.Q. and mental age have empirical foundations only for children developing in a normal milieu. Thus, applying these concepts to the performances of adults must yield results of dubious significance. In work with psychotic persons, moreover, the competitive spirit, the desire to excel, interest in almost any task set by another person, and other common governors of psychological activity which the philosophy of the tests assumes to be equal are either absent or grossly warped. A patient's performance, therefore, may or may not be representative of his ability or his normal efficiency which the tests are too frequently

assumed to measure. While one skilled in the art of testing can report whether or not results are representative, he frequently cannot put his finger on the reason he intuitively knows, and the tests do nothing to uncover these factors controlling the patient's performance. As a result, from those committed to the use of the tests one hears much of such 'insurmountable obstacles' as the 'uncoöperativeness' of patients. As it is exceedingly likely that the true psychological differentiæ of the disorders are to be found among the reasons why the tests do not work more successfully, their continued use in the customary manner would hardly seem warranted. Nevertheless, the results already obtained, while they are for the most part exceedingly crude, are of interest. We may summarize them as follows: (1) Any psychosis tends to involve some loss of efficiency or possibly of capacity. (2) The patient's vocabulary appears least affected, and a test of vocabulary may be utilized as a point of reference for measuring the loss in an individual patient or in groups of patients. (3) The loss is apparently greatest in disorders which involve demonstrable damage to the tissue of the central nervous system. (4) In the 'functional' disorders the results from the test appear to indicate that the loss is greatest for those tasks in the scales involving the most self-government or control.

B. *Memorial Efficiency.* Memory as it has been studied in psychotics has been generally conceived as an ability to fix and to retain impressions. Thus, the investigations belong under the general topic of efficiency or capacity.

Four investigators have included tests of memory in studies of general efficiency. Foster (56) analyzed the performances of a large group of patients on the memorial tests in the Stanford-Binet scale. Deteriorated feebleminded subjects, arteriosclerotics, and cases of senile dementia drew forms from memory sketchily; while schizophrenics, paretics and cases of manic-depressive insanity tended to elaborate. The former group and the manic-depressives tended to draw in reduced size, whereas schizophrenics and paretics tended to reproduce objects larger than the model. Scores for drawing forms from memory and for the reproduction of short paragraphs tended to increase with mental age and to decrease with chronological age. Normal subjects were superior to psychotic patients of the same mental age, indicating to Foster that memorial efficiency suffers greater loss than "general intelligence". Unfortunately, the diagnostic differentiæ obtained in this study appeared to follow no logical

pattern. The lines are crossed between groups with known neural lesions and those without.

In her large study of dementia praecox, Babcock (6) found that memorial efficiency almost always suffered more than the vocabulary. Schwarz (158) found the mental age of 110 schizophrenics on the "memory of a paragraph" test to average only 53.4% of the mental age obtained for the vocabulary test.

Attempting to determine whether her patients exhibited a specific memorial deficiency, Simmins (163) found that, once the loss of "g-ability" had been taken into account only 8.5% showed such loss. These were patients suffering with paresis and epilepsy, so again the integrity of the central nervous system appears as an important condition for psychological efficiency.

1. *'Impression' and 'Retention'.* A number of investigators have defined the 'formation of associations', or 'impression', and 'retention' as separate aspects of memorial ability which might be separately affected by the psychoses. Hull (84), in one of the first studies of this sort, employed the method of paired associates with 3 schizophrenic patients, 3 diagnosed as constitutional inferiority, and 3 paretics. Ten normal individuals served as controls. His results indicated that the difficulty for the patients lay in the "formation of associations". Every patient required much longer to learn the series than did any of the controls. Those diagnosed dementia praecox suffered the least in this respect, while the paretics suffered the most. Once a series had been learned, it was retained practically as well by the patients as the normals.

In a similar study with patients suffering from Korsakow's psychosis, Wechsler (184) concluded that, "psychologically, the essence of their memorial difficulty consists in an inability to form new impressions", *i.e.* "a loss at the fixation stage of memory". In an attempt to answer the same question for patients with such disorders as paresis, cerebral syphilis, senile psychoses, cerebral arteriosclerosis, and Korsakow's syndrome, Liljencrants (109) found that shortening the time of exposure reduced the number of objects remembered about 4 times as much for most of her small group of patients as for the controls. Exposure time was exceedingly important also for recognition after an interval and for the span of memory. She concluded that, while retention and apprehension are affected in varying degrees and both aspects are involved, for most 'organic' patients the impairment is greatest for "apprehension".

Moore (120) has also compared the efficiency of "perception" (impression) and "memory" (retention) in cases of paresis, senile dementia, and chronic alcoholism. The efficiency of "perception" was tested by having the patients name a series of 50 objects as quickly as possible, that of "memory" by exposing several series of 8 objects and immediately asking the patient to name or describe as

many as he could. When the patient had halted in this immediate recall, he was engaged with other tasks for an interval, then asked to recall the objects in the series again. These procedures gave Moore separate data for 3 capacities, perception, immediate memory, and retention. With occasional exceptions, he found these 3 deteriorating together. Employing Spearman's tetrad-criterion, he found evidence distinguishing immediate memory and the power of retention as separate mental faculties. Neurological speculations were presented.

2. *Recognition and Recall.* The memorial efficiency of disordered persons has also been investigated by the methods of recognition and recall. Achilles (**2**) includes in a study of those 2 methods *per se* an investigation of their comparative efficacy with patients suffering from paresis, brain syphilis, arteriosclerosis, or Korsakow's syndrome. Every patient in Achilles' small group exhibited some memorial impairment in both types of test. While the scores for recall averaged comparatively lower for the patients than for the control subjects, there was considerable variation between the scores of recall and of recognition. Of the various diagnostic categories used, patients with Korsakow's syndrome exhibited the lowest scores.

Wylie (**207**) investigated these 2 aspects of memory, using a group of 30 patients with 20 control subjects.

The patients were divided into deteriorated (7 senile cases, 3 presenile, and 6 paretics) and non-deteriorated (5 manic-depressive patients, 6 schizophrenics, and 3 psychoneurotics) groups. Pictures, Chinese symbols with English equivalents, and Chinese symbols with Roman equivalents constituted the material presented. The deteriorated patients proved so poor in the performances that the series had to be shortened for them. The senile patients and one case with Korsakow's syndrome failed utterly in the tests of recognition, confirming Achilles' findings with such patients. All the deteriorated cases tended to confuse the 'new' and 'old' material in the tests of recognition. In the non-deteriorated group the scores for recognition were always better than the scores for recall, and the difference between the two averaged approximately 4 times as great for the patients as for the control subjects.

Wylie concluded that " in the process of deterioration recognition tends to disappear for those cases where new impressions can no longer be grasped. In cases, too, if there is any recall it is of small span and of brief duration ". Among the diagnostic categories in the non-deteriorated group, the schizophrenics' scores were most frequently nearest the normal, the scores of the manic-depressive patients next, and those of the psychoneurotics worst. These results are contrary to what is commonly believed, and it is likely that Wylie's groups were too small to be representative.

Memorial efficiency has also received consideration in studies by Smith and by Gatewood. Smith (**165**) worked with epileptic patients ("5 rational and 5 demented") and 6 controls. Among his tests were one of recognition and one of immediate recall in which were employed pictures, words and letters. His analysis was qualitative as well as quantitative. He found in the gradation from normal subjects to "demented epileptics" an increase in forgetting on both types of test. "Errors of confusion" were more prominent, however, than those of forgetting. On the tests of recall the epileptics inserted words and letters not given, confused the order, and repeated themselves. On the tests of recognition they confused 'new' words and pictures with 'old'. These tendencies increased with the degree of clinically observed dementia.

Gatewood (**65**) found that errors of confusion, similar to those observed by Smith with epileptics, were also prominent in recall and recognition by schizophrenics. Moreover, while the control subjects in Gatewood's study improved their scores with a second repetition of the impression, the schizophrenics only tended to make more errors. Again, the errors of the control subjects tended to be consistent while those of the patients varied. These findings indicated to Gatewood that the patients shifted their methods of memorizing, and that they suffered from a "lack of thought control". In a gross way, Gatewood, as the reviewer believes, has indicated correctly the realm of much of the schizophrenic's difficulty. Research here should be aimed at an analysis of these shifts of method in order to uncover any psychological factors underlying them.

As did other investigators, namely, Achilles and Wylie, both Smith and Gatewood found that meaningless material offered comparatively more difficulty for the patients than for the control subjects.

3. *Tests of Memory.* Wells and Martin (**198**) have devised and standardized a test of memory for use in clinical practice. The questions and tasks in the tests are grouped to give a picture of the patient's efficiency in answering questions involving personal facts, current information, or school information, and in repeating simple statements or series of digits immediately after their being presented. Tasks of recognition are also included. The score is a memory quotient (M.Q.). In the first use of the test by its authors, the average scores for several diagnostic groups were: senile psychosis 53, paresis 68, manic-depressive insanity 74, and dementia praecox 82. It is obvious here that memory is conceived as a sort of store-house of information. The test is suited to give one a general index of the patient's efficiency in answering questions and to give a clue to the realm in which he is relatively most weak.

Beble (12) has employed this test with 21 cases of encephalitis lethargica, between 20 and 34 years of age. Most of the patients in the group exhibited a probable loss of efficiency on the test. High scores were found on tests of old personal information, current information, alphabet, counting backward, repeating sentences, the easy paired-associations test, and the test of recognition. Low scores appeared for tests of school knowledge, substitution, difficult paired-associations, repeating digits backward, and naming objects.

4. *Summary and Criticism.* In this group of studies, again, the tester's philosophy is predominant. The control of most of the psychological governors is inadequate because it is not understood. Even the conception of memory varies. Nevertheless, certain facts stand out.

(1) The performances of psychotics on the memory tests of the scales of intelligence are less efficient, comparatively, than their performances on the vocabulary test.

(2) 'Impression' suffers more than 'retention'.

(3) 'Impression' appears to suffer most in cases with psychoses involving known neural damage.

(4) The psychotic's inefficiency is evident in tests of both recall and recognition. Differential loss here has been indicated in isolated cases, but not established.

(5) The psychotic's success at committing to memory is apparently reduced relatively more than the normal's by the presentation of meaningless material.

(6) The psychotic's fund of available information is reduced. The reduction is apparently greatest when neural insults are involved, and information recently acquired tends to be lost first. These findings are interestingly similar to those obtained by Franz and Lashley from insulting the brains of various animals.

C. *Learning and Habituation.* 1. *Experiments.* Learning, too, has been commonly regarded as a measurable capacity by workers in psychopathology. To determine whether this capacity suffers in the psychoses has been the task for the majority of the investigators.

In one approach to the problem control subjects and patients are compared (1) for the number of repetitions required to learn a given set of material (usually nonsense syllables), and (2) for the effect of lengthening the series in terms of repetitions.

Barnes (10) found evidence of loss in all of her patients on both criteria. The effects of retroactive inhibition were also exaggerated. Indeed, Barnes concluded that the manifestations of all "sources of confusion" were exaggerated in the performances of psychotics. Wylie (207) obtained similar results from a comparison of patients with known lesions and those without.

Her "deteriorated patients" (paresis, senile dementia, and Korsakow's syndrome—all diagnoses involving known lesions in the central nervous system) failed with series of even 6 syllables, while her "non-deteriorated group" (schizophrenia, manic-depressive insanity, and psychoneurosis—without known lesions) succeeded with series of 12 syllables.

Gardner (64) has investigated the learning ability of 100 schizophrenic and 100 manic-depressive patients by way of its manifestations in their achievement in school. The grades of the schizophrenics tended to be poorer than those of manic-depressives. Moreover, schizophrenics failed to attain a grade-status equal to that reached by the latter group. Special abilities in art and in music, however, appeared more prevalent among the schizophrenics than among the manic-depressives.

Another way of determining whether learning capacity suffers in the psychoses has been to compare the effects of practice upon efficiency in patients and controls. Most of the investigators employing this method, however, have been as much interested in other factors as in learning capacity. Gatewood (65) has a group of 8 schizophrenic patients repeat a set of tasks over a series of weeks. While some of these patients did improve their output, they improved less than did the control subjects. Most striking were the extreme daily variations in the output of these schizophrenics. The trends correlated with and often preceded changes in clinical condition, but Gatewood observed nothing of a psychological nature to account for them. He believed, however, that decrements of output resulted from "a loss of the goal idea", and, as mentioned before, that the performances of the schizophrenic were characterized by a "loss of thought control".

Kent (101) found that even grossly "deteriorated" schizophrenic women improved their output to some extent when they were made to perform at regular intervals without artificial incentives. The amount of improvement, interestingly enough, appeared to be contingent upon the "method employed by the patients".

In this study Kent was also interested in the possibility of a transfer of training, important for therapeutic and economic considerations. While 16 patients increased in the slope of their learning curves with several forms of a cancellation test, Kent considered that such evidence of improvement might be due as much to general adaptation as to transfer of practice. In a repetition of Kent's study, Boring (24) employed patients less grossly disordered, and to the list of laboratory tasks he added the industrial operation of rug-making. Again the patients increased their output on the laboratory tasks; they also learned to make rugs. Evidence for a transfer of the effects of the training to general behavior was equivocal. Favorable therapeutic effects were observed in only 4 of the 8 patients.

Wells (191) examined efficacy of practice on simple tasks as a therapeutic

agent in a single case of hysterical amnesia. While the patient's output increased at a rate approximately normal for those tasks emphasizing speed, little or no improvement occurred in tasks emphasizing ingenuity, information, or accuracy. Transfer, likewise, appeared only where speed was involved. Psychotherapy proved much more effective than did this type of training.

Interesting effects of practice on motor tasks have been important by-products of work at Worcester State Hospital. Shakow (160) and Huston (89) have described work with over 100 schizophrenic patients on the Miles prodmeter and a pursuitmeter respectively. These patients performed at successive sessions at intervals of 3 months on these motor tasks which both involve following a target with a stylus. Although the scores were poorer for patients than for controls, the patients improved from trial to trial and from period to period. Many of them even exhibited improved scores between the last trial of one session and the first trial of the succeeding session, whereas control subjects tended to manifest forgetting after the rest periods of 3 months. This latter type of improvement was attributed to some general sort of adjustment made by the patient to the experimental situation. Diagnostic differences appeared among the subtypes of schizophrenia which were similar for both situations, namely, that paranoids and indeterminates adjusted more rapidly than catatonics and hebephrenics.

A study by Bender and Schilder (17) also belongs in this group. These writers attempted to establish in 16 stuporous, catatonic schizophrenics a conditioned response to a light or touch when the natural stimulus was a strong faradic shock. Some evidence for "conditioning" appeared in all subjects who would lend themselves for the experiment, but 5 of the 16 refused to coöperate after 1 or 2 shocks. Responses to the light or the touch took the following forms: (1) removal of the hand from the electrode (natural reaction) in 2 patients, (2) ambivalent reactions consisting of small athetoid movements and slow crawling away from the electrode, interpreted to result from simultaneous impulses to follow the experimenter's instructions and to respond to the light or touch, and (3) partial responses consisting of lifting one or two fingers. Similar responses were obtained by touching other points on the patient's body, indicating to Bender and Schilder that the psychological changes of a stuporous condition result in an "incomplete analysis of the situation".

2. *Summary and Criticism.* Few clear-cut facts are established by this group of studies. It appears fairly certain, however, (1) that psychotic patients seldom increase their output as rapidly or as much

as normal persons, (2) that training on psychometric tasks has little therapeutic value, (3) that there is insufficient transfer of any training to aid the patient in his general adjustment to living, (4) that some schizophrenic patients are markedly more variable in their output on successive performances than the average person. There is also some evidence that patients improve relatively more on tasks of a stereotyped nature than on tasks requiring ingenuity or information, and that where transfer of training occurs, it probably results from a general adjustment to the experimental situation. Again the points of real difference between the psychotic and the non-psychotic are merely hinted. Differences in efficiency cannot be interpreted to occur as a result of the effects of psychoses upon capacity because the uncooperativeness of the patients is not understood and cannot be controlled. But what factors govern these changes in efficiency? What governs the schizophrenic's variability?[8] An experimental attack must be made directly upon such aspects of the disordered person's psychology.

D. *Speed and Accuracy of Movement.* 1. *Experiments.* Studies of capacity and efficiency have also included tests of the speed and accuracy of movement. For speed the tapping test has usually been employed.

Franz (**59**) included it in his study of 4 manic-depressive patients, and found the rate for the manics equal to the normal, but the rate for the depressed patients considerably reduced. Smith (**165**) found his epileptic patients very little slower in tapping than control subjects; the average number of taps a second were: control subjects 6.3, non-demented epileptics 6.0, demented epileptics 5.9. Gatewood (**65**) found schizophrenic patients slow and variable in their tapping (4.3 ± 1.12 taps per second for 30 seconds). In most instances they became slower as their condition became worse, but one patient actually increased his rate as his disorder progressed. It was as if the tapping had become automatic and was out of voluntary control. Boring's (**23**) dementia praecox patients averaged somewhat faster than Gatewood's ($5.5 \pm .86$), but the average for the group was still slower than that for controls.

Accuracy and control of movement, too, have received but little consideration. Boring (**23**) included an aiming test in his study of schizophrenics, and found these scores definitely poorer than those of college students. Errors in the aim were increased markedly by increasing the number of strikes a second.

[8] The writer has already attacked this particular problem (in press), finding the variations in the schizophrenic's output following variations in his aspiration, *i.e.* his output varies with the self-instructions with which he enters the task. In another study, done with Dr. R. G. Hoskins (in press), he found that the aspiration and output of some schizophrenic patients could be raised by the administration of thyroxin.

They also increased slightly after the first day, due, Boring thought, to a partial lapse of the *Aufgabe*. Smith (165) tested the control of movement in his epileptics by having them press with a forefinger the bottom of a Marey cardiograph which was connected with a tambour. Although the patients pressed the tube somewhat differently from the manner of the control subjects, these differences were not correlated, as Smith had expected, with the clinical condition of the patients.

Saunders and Isaacs (155) employed Downey's line-drawing test which is supposed to test motor control, imperturbability, and patience. The task consists in drawing a line as slowly as possible. Psychotic patients tended to shorter times than control subjects, indicating less control. Although differences among the patients appeared, they did not distinguish the various diagnostic groups. As Saunders and Isaacs were looking principally for diagnostic aids, they failed to classify their qualitative results.

Quinan (144) has approached the control of movement in psychotic patients by way of handwriting. Two hundred normal persons and 148 paretics wrote the sentence, "He protested that he could not eat the twenty-two tarts; and the truth is he ate twenty". Quinan measured the test-lineage and the length of the t-crossings in these 348 specimens, and found them similar for both groups. The paretics, however, wrote more slowly, frequently omitting words. They usually compressed the characters in the test in irregular fashion, and allowed the line of their writing to take an upward slope. All these findings indicated a loss of fine motor control in the paretic patients.

2. *Summary and Criticism.* All of these studies of speed and accuracy of movement stand in a rough exploratory stage. As yet not even a survey of the various diagnostic groups has been made with such motor tasks. Even so it is fairly established (1) that psychotics usually exhibit less speed and accuracy in their movements than do normal subjects, and (2) that manic patients are nearly normal in speed while depressed patients and schizophrenics tend to be slow.

II. Investigations of Reaction Time

A. *Reaction Time.* 1. *Experiments.* With the early prominence of the personal equation in laboratories of psychology, it followed that psychologists would measure reaction time when they initiated an experimental attack upon the disorders. As early as 1890 Bevan-Lewis (19) published reaction times for several of the diagnostic groups. Epileptics and alcoholics averaged longest, with the times of depressed patients and paretics only slightly shorter. Although the manics constituted the fastest group among the disordered, the average times approximated those of the other psychotic groups more closely than the times for normal persons. This was a surprise to investigators of that day, and is among the earliest of experimental

results which have established the fact that a disordered person never gains in efficiency, but almost always loses.

During the first decade of this century a number of men with varying views and purposes measured the reaction time of psychotic patients. To determine the effects of depression and excitement, Franz (58) measured in one depressed patient simple reaction time and the time of a reaction involving a choice of hands. These measures were taken day after day for 13 weeks. Reaction time changed with the patient's condition, but more interesting to Franz was the fact that his choice reactions were equal to or shorter than his simple reactions. He considered then that such an anomaly might characterize depression. When Franz (59) included measures of simple and choice reaction time in another long study of 6 subjects (2 manic and 2 depressed patients and 2 controls), however, exaggerated simple reaction times appeared for only one of the depressed patients. While the times for the excited patients as well as for the depressed patients were consistently longer than those of the slowest control subject, Franz was able to conclude very little from his study and appears to have been disappointed with the method.

Yerkes [4] early pointed out that the times of reaction and the variability of these times within a single experiment might be employed as indicators of two separate functions (general readiness to respond and the stability of attention, respectively) in the comparison of psychotics with normal persons. The times have been used for this purpose by several investigators. Wells and Kelley (197) found the simple reactions of 28 patients with manic-depressive insanity or dementia praecox only slightly slower than normal. The differences between controls and patients were smaller than those obtained by Bevan-Lewis and by Dodge and Diefendorf. Neither did the tendency for manics to have faster times than depressed patients appear. Simple reaction time was materially slowed only for paretics and for one case of cerebral syphilis. Increased variability appeared for the manic-depressive group but not for the schizophrenics. As the difference found was small, these writers could not conclude that attention was materially affected by the disorders. Another measure, the ratio between auditory and visual times, was found to be small for the schizophrenics, large for paretics, and normal in manic-depressive insanity.

Lundholm (112) measured the reaction time of 12 manic-depressive patients, 2 schizophrenics, and 2 controls twice weekly for 7 months. Distribution curves of the times were broad and low for the manics, narrow and high for the depressed patients and the controls. The standard deviation of the times always increased as a patient went into a manic state. Some relation also appeared between the amount of variability and the degree of the excitement. Lundholm concluded variability of performance, viewed as an indicator of the stability of attention, to be the most significant symptom of disorder.

[4] Yerkes, R. M., Variability of Reaction Time. *Psychol. Bull.*, 1904, 1, 137–146.

He distinguished three types of attentional disorder: (1) an active, variable type with new "contents" continually emerging, (2) an active, recurrent type with one "content" continually reasserting itself, and (3) a passive type in which all "contents" disappear leaving "blank feelings". These types cut across the lines of diagnosis.

Dodge and Diefendorf (**43**), hoping to demonstrate objectively some psychomotor characteristics of the various disorders, included ocular reaction time to a peripheral stimulus in an early study of eye movements. They used a recorder developed by Dodge in which a beam of light broken by a timing fork of 1,000 cycles was reflected to a moving film from a mirror, actuated by the corneal protuberance of the closed eye. Ocular reaction time was obtained by counting the segments in the beam's impression registered before the subject's eye turned. The severity of the patient's condition was reflected only slightly in his ocular reaction time, but paretics and depressed patients tended toward longer times than did dementia praecox and manic patients.

Ambitious to provide from the psychological laboratory an objective method for diagnosing the mental disorders, Scripture (**159**) sought distinct differences between the various diagnostic groups. His set-up consisted of a kymograph placed opposite a screen with a small hole through which the subject got a visual signal to press a reaction key that caused a mark upon the drum. The records yielded 3 measures: reaction time, variability of reaction time, and variability in the "holding time", obtained from the lengths of the lines made on the kymograph paper by the various ways in which the subjects pressed the key. The performances of the psychotics exhibited several variations from those of the controls. There appeared 3 types of alcoholics: (1) a tense group characterized by regular reaction times, long holding times and little fatigue; (2) a sluggish type who started slowly but later approached the normal in reaction time, also characterized by small variability and long holding times; and (3) a disintegrated type whose records were extremely irregular and variable throughout. Patients with hysteria presented records characterized by extremely variable times, some of which were normally brief, and long holding periods which, according to Scripture, were evidence of their "mental inhibition". Epileptics were slow but regular in all aspects. Two paretic patients in the early stages of disorder presented times almost normal, but broken holding lines gave evidence of tremor. Longest reaction times and longest holding times were found consistently among depressed patients. There was considerable overlapping between the various diagnoses and between patients

and normals, but Scripture remained optimistic about the value of reaction times for diagnosis.

With a purpose and method similar to Scripture's, Saunders and Isaacs (155) found a wide range of reaction times and variability for both normal subjects and 31 psychotic patients. Barely significant statistical differences appeared between psychotics and control subjects and between some of the diagnostic groups, but none was large. A tendency for many of the psychotic patients to give anticipatory responses was considered suggestive.

Considering adaptation to living to imply proper choice reactions, Wells and Sturgis (199) compared 12 schizophrenics with a group of controls in choice reaction time. They employed a five-finger key and series of 5 digits or letters. In one series only one key, designated by an underlined digit, was struck. In the others the items presented indicated the order of striking. The latter procedure yielded 2 measures: the time of the first reaction, and the time for the whole series. Outstanding differences were scarce. The schizophrenics were somewhat slower than the controls in picking the designated key and in the first reaction of a series, but only 2 patients were definitely outside the range of the controls. Times for the whole series exhibited more difference, indicating that the patients did not gather in the general situation as completely and quickly as did the controls. As the tendency to make false reactions was no greater for the schizophrenics than for the controls, Wells and Sturgis found the theoretical standpoint of this study unvalidated. They concluded that their failure to find pronounced differences indicated that "the functions governing vital adaptation to life are dissociated from and independent of those governing these simple psychomotor adaptations", and that schizophrenic patients are not constitutionally different from normal persons on the psychomotor level.

2. *Summary and Criticism.* Positive and interpretable results from measuring reaction time in the disorders are few. Considerable disagreement is evident among investigators, but one may fairly say: (1) that there is at least a statistical tendency for reaction time to be lengthened in all psychotic patients, (2) that depressed patients tend to have longer reaction time than do manic patients, (3) that patients with 'organic' disorders exhibit longer times than do those with 'functional' disorders, and (4) that the variability of individual reactions tends to be greater than normal in all disorders and is likely to be especially great in manic patients. Interpretations of these differences have varied, but few of the interpretations have been put into experimental settings. Careful work on the effects of various psycho-

logical conditions on the reaction time of psychotic patients, therefore, might still yield interesting results.[5]

B. *Latent Period of Reflex Movements.* 1. *Experiments.* With a view to determining the functional relationship between higher and lower centers of the nervous system, Travis and his colleagues have made electromyographic determinations of the reaction time for the patellar-tendon reflex in various neurological and psychotic disorders. Travis (**180**) found the reflex time of a cataleptic patient extremely short (0.0059 sec.) during the early phases of the condition. This time progressively lengthened during the course of convalescence, until at the time of discharge it was normal (0.018 sec.).

Travis believed this lengthening of reflex time during recovery occurred because the correlation centers, as they improved, gradually exerted more and more inhibition upon the lower reflex centers. In this light, the increase in reflex times was evidence for a reciprocal relationship between the higher and lower neural centers. Investigating this relationship again in a small group of psychiatric and neurological cases, Dorsey and Travis (**46**) found the reflex times gradually increasing with clinical recovery in a case of toxic infection which presented the catatonic syndrome. In a case of hypermania (manic-depressive) they found times longer than normal (0.0206 sec.). These became reduced to below normal, in the course of a few days, as the patient's condition tended toward depression. A case of brain tumor yielded longer reflex times on the affected side than on the unaffected side, a relationship which was reversed after operation. Measurements in 31 psychotic patients with manic-depressive insanity and the catatonic type of schizophrenia by Travis and Dorsey (**181**) yielded reflex-conduction rates below normal for the catatonic group. Times for patients in the depressed group were within the normal range. Arguing that cortical activity is increased in manic and decreased with the catatonic syndrome, Travis and Dorsey considered these results confirmatory for their theory of reciprocal relationship between higher and lower centers.

Dysinger (**49**), working in Travis' laboratory, measured reflex times for a large group of patients representing many diagnoses. He found the greatest deviations from normal and the greatest variability among 'organic' cases. The times were slightly but significantly different for the left and right sides in

[5] In a study of this kind to appear during 1936 in the *J. Gener. Psychol.*, Huston has been able to show that as the situation is made more complicated, putting added responsibility upon the subject, the differences between the reaction times of schizophrenics and of normals are increased.

11 'organic' cases. There were also a number of qualitative deviations in the records of the various patients. His results generally confirmed those of Travis and of Travis and Dorsey.

2. *Criticism.* These results from the electromyographical measurement of reflex times are extremely interesting and valuable, but the conclusions which Travis draws appear to the writer to involve circular logic. As we know little or nothing concerning cortical activity in the various manifestations of disorder, it seems rather fortuitous to argue from them through such measurements to a reciprocal relationship between higher and lower centers. Just because the manic exhibits much activity and the catatonic little need not mean that the cortex of the catatonic has ceased to function. As there is considerable evidence from other sources for this reciprocal relationship between higher and lower centers, one might better argue from that evidence, than from Travis' measurements, as to what is the condition in the higher neural center of various types of psychotic patients. But let us use the facts as they come. Such measurements can be checked by other investigators and their significance will gradually appear.[6]

III. Continuous Work (Work Curves and Fatigue)

A. *Investigations.* The method of continuous work for the investigation of voluntary factors in the activity of psychotic patients was a product of Kraepelin's genius. Hoch (**78**) first employed it in this country. Using the ergograph, he obtained 3 exhaustion curves, allowing rest-periods of 15 minutes, from each of several depressed patients. These patients exhibited an interesting tendency to lift the weight an increased number of times in each successive test. As the hands were alternated, Hoch argues that some general resistance within these patients must be overcome, yielding an increase of facility instead of fatigue. A similar reversal was found by Strong (**171**) in 2 of 3 depressed patients who performed on the tapping test. As cancellation tests failed to show it, the reversal was considered a motor phenomenon.

[6] Work by P. E. Huston (The Reflex Time of the Patellar Tendon Reflex in Normal and Schizophrenic Subjects. *J. Gener. Psychol.*, 1935, **13**, 3–41), appearing within the year, has failed to substantiate Travis' findings with schizophrenic patients.

Wells (**185**) found that, whereas normal persons and especially manic patients started rapidly in the tapping test and gradually reduced their rates in successive trials, depressed patients started slowly and successively increased their speed. Nothing of significance appeared in the work curves of schizophrenic or paretic patients.

Using Woodworth's substitution test, Wells and Currie (**194**) obtained the reversal typical of the motor activity of depressed patients. Computing the percentage of the time required by the first line for each successive line, they found this to be more than 100% in all except extremely slow workers, usually depressed patients. Thus, this tendency for depressed patients to become released as they continue performing appears outside purely motor activity.

The work (already discussed under *Learning and Habituation*) by Shakow (**160**) and Huston (**89**) of the Worcester State Hospital, in which schizophrenics exhibited improved scores after rest-periods of 3 months when normal subjects showed forgetting, indicates that there may be typical work trends for schizophrenic as well as manic-depressive patients.[7]

B. *Summary and Criticism.* Work curves which involve an improvement where fatigue should be manifested have been fairly established as typical of depressed patients. An interpretation of the finding is still uncertain. Investigators might in the future determine whether these reversals are related to other phenomena, biological or psychological, which characterize depression.

As most of the work with the method of continuous work has been published in German, it cannot be reviewed here. The promise of the method for coöperative researches and for testing the effects of therapeutic methods should lead Americans to examine the German literature.[8]

IV. Investigations of Motor Phenomena

A. *Ocular Movements.* Work with ocular movements began in 1908 with the study of Dodge and Diefendorf (**43**), already mentioned under *reaction time*. Their technique (recording eye-movements on a moving photographic film with a mirror-recorder actuated by the corneal protuberance) yielded "angular velocity" and certain characteristics of the "pursuit reaction" as well as ocular reaction time. Angular velocity for a visual angle of 25° suffered little in most of the disorders, but was reduced for depressed patients. Greater variations from the normal appeared in pursuit reactions. Paretics exhibited a variety of small "inadequate" movements. The records

[7] This work is available at present only in abstracts, but it will appear shortly in the *J. Gener. Psychol.*

[8] Most of the important titles for this literature are to be found in the volumes of Kraepelin's *Psychologische Arbeiten.*

for depressed patients and epileptics showed them making long sweeps which frequently passed the point to be fixated. The schizophrenics also made short step-like movements somewhat similar to those of the paretics.

Recently Dodge and Fox (44) revived this method of investigation. Calling the phenomenon " optic nystagmus ", they have divided the movements into " slow " and " quick " phases. The wide sweeping movements of pursuit constitute the slow phase, and the small rapid movements involved in fixating constitute the quick phase. They have found that peripheral stimuli were still effective in a case with central scotoma of the right eye and paralysis of the left external rectus muscles, whereas with the left eye they were effective only in the extreme nasal and temporal positions.

Couch and Fox (34) have investigated ocular pursuit of a pendulum, optic nystagmus, response to commands to look right and left, and response to peripheral stimuli in 117 patients and 16 control subjects. Except for deviations resulting from " lapses of attention ", the records of 60 of the patients were normal. Normal ocular responses were obtained occasionally from a very sick patient. Short step-like interruptions of pursuit movements, considered characteristic of schizophrenics by Dodge and Diefendorf, appeared in the records of 41 patients of various diagnoses. (Again objective measures are found not to follow diagnostic lines.) Eighteen of the most disordered patients, 5 in catatonic stupor, exhibited profound disturbances of the ocular adjustment in both phases. Extreme variability appeared in these records. No interpretations were made at this stage of the investigation. An exception: the records of 3 catatonic patients showed their eyes moving in a direction opposite to that of the pendulum. Couch and Fox considered this a manifestation of the negativism which is supposed to characterize catatonic patients. The interpretation is, of course, fallible but this is the first evidence of negativism to an occasional instruction. It deserves further investigation.

B. *Muscular Tonus.* Muscular contraction and relaxation in the disorders have received consideration principally in the work of Edmund Jacobson. In his book, *Progressive Relaxation,* Jacobson (91) describes muscular hypertension as a fundamental factor in psychoneurotics exhibiting several constellations of symptomatology, and also in manic patients. Employing an electrical method which measures very small degrees of muscular contraction in terms of microvolts of potential difference, and which gives a continuous

record over a period of time, he has shown not only that hypertension is characteristic of people suffering from these disorders, but that the patients can be trained to relax. Once relaxed their symptoms often disappear. The kernel of the method of "progressive relaxation" consists in teaching the patient to recognize muscular tenseness in various groups of muscles, and then having him relax the tenseness away. The patient's success is measured objectively by means of the electrical apparatus.

In studies specifically of the forearm flexors, Jacobson (92, 93) found that healthy students without training are unable to relax completely. Patients suffering from various neurotic complaints first exhibit marked hypertension and fail utterly to relax when so instructed. After training, however, they are able to relax almost completely, and more rapidly following a signal than do the untrained students.

Employing the resistance of the subject's arm to flexion, Katz (100) has made daily determinations of tonus in a number of female psychotic patients. Considerable daily variation appeared in the records of the same individuals, and tended to be greater in the manic state than in other conditions. No relationship appeared between tonicity and age, basal metabolic rate, height-weight ratio, or the menstrual cycle.

Gaylor and Wishart (66) have investigated the metabolic cost of sustained postures in normal and catatonic subjects. The metabolic rate was increased during sustained postures over the rate under basal conditions for both groups, but the increase was about 20% greater in the control subjects imitating the postures than it was in the catatonics.

C. *Miscellaneous Motor Studies.* Chandler (33) has compared the relationships between hand, eye, and foot preferences in 100 schizophrenics, 100 manic-depressive patients, and 200 college students. The results were: (1) more psychotic than normal individuals prefer a non-corresponding eye with corresponding hand and foot; (2) more normal than psychotic individuals have a preferred eye, foot, and hand correspondence.

Franz (60) made an early study of the knee-jerk in paresis. He found the latent period, by methods crude for today, usually lengthened in the paretic exhibiting reflexes either exaggerated or diminished. No relationship appeared between the knee-jerk and mental phenomena in paresis. Three progressive stages of the effects of paresis were: exaggerated reflexes, then diminished reflexes, and finally, absence of the knee-jerk.

D. *Summary.* It is too early to decide upon the promise of the work with ocular reactions, but results which are very promising both

for theory and for therapy have appeared in the work on muscular tonus. Jacobson's work contains fairly conclusive evidence that the whole body, the muscular systems as well as the nervous systems, is involved in neurotic disorders which, as functional disturbances, are all too frequently viewed as purely mental affairs. His work also yields a remarkable therapeutic method for which there is an objective test.

V. Investigations of the Apprehending Functions

A. *Perceptual Thresholds.* Few investigators, publishing in English, have attacked the problem of perceptual thresholds with disordered persons. The reason is probably that given by Franz (61) in an attempted study of tactual thresholds and qualities in disordered persons. The psychophysical methods, he found, were too demanding and too tedious to be useful. In spite of Franz' plea, no other methods have been forthcoming.

Only the threshold for electrical stimulation has been investigated with any degree of thoroughness, and the results are conflicting. Grabfield (70), believing the threshold for electrical stimulation to be an index of general nervous irritability, gave induction shocks, measured in Beta units by Martin's method,[9] to 135 patients selected at random. In this first study the average thresholds for every diagnostic group was above that for his control subjects.

In a later study of 149 manics and 287 depressed patients, Grabfield (71) found the limens of the latter group ending higher than those of the manics which were scattered about the mean for normal persons. Repeated determinations on a few depressed patients found their limens lowering as the depression became less profound. Hallucinated and deluded patients, depressed or manic, usually had higher than average thresholds. In a third study, Grabfield (72) found considerable inconsistency in the limens of schizophrenic patients. The thresholds were constant for only one-third of 51 schizophrenics, but this variability was unrelated to the emotional condition of these patients. As schizophrenics with somatic delusions tended toward higher thresholds, this writer believed these delusions might be associated with some disturbance in the receptorial mechanisms. In a fourth study, Grabfield (73) found that psychoneurotics and patients with various traumatic neuroses exhibited thresholds no different from those of normal persons.

Huston (90) objected to Grabfield's technique, namely, to his use of only 4 series, only ascending series, no preparatory signal, and of

[9] Martin, E. G., *The Measurement of Induction Shocks.* New York: John Wiley & Sons, 1913.

stimulating with induction apparatus where the wave-form of the shock is altered with the intensity. Huston used direct current, obtaining the limens in volts. He employed the method of limits, getting 20 determinations by ascending series and 20 by descending series. Thresholds obtained in this manner from 64 schizophrenics were not significantly different from those of 28 control subjects in the mean nor in scatter about the mean. A slight difference insignificant on the first test disappeared with a second test, and was interpreted to result from a slower adjustment to the test situation by the schizophrenics. The method was considered not promising.

B. *Perception and Preference of Colors.* Years ago Baird (**8**) measured the color zones of 1 hysterical and 5 neurasthenic patients. Using a campimeter with Hegg's colored discs, he brought each of the Herring primary hues in 3 times on each meridian. Three persons with normal color vision were used as controls, and all the patients used had passed the Holmgren test. The average size of the color zones in the retinas of the patients was only 83% of the average for the controls. Especially prominent was the diminution in 3 of the neurasthenic patients. Contraction of the red and green zones was similar; and the blue and yellow zones likewise contracted together. While differences appeared here between the color zones of these neurotics and these controls, the sample is obviously too small to be significant.

Hrdlička (**83**) investigated the presence of color-blindness in a large group of psychotic patients to find its prevalence no greater than it is in the population at large.

Katz (**99**), in the hope of using color as a therapeutic agent in the decoration of rooms and in materials used in occupational therapy, determined the preferences of 430 patients for 6 of the Bradley colors. Employing the order-of-merit method, he found blue most pleasing for all groups. Green was a distant second with red, violet, yellow, and orange following in order. The popularity of colors of shorter wave-lengths was more pronounced for patients of short hospital residence, while the longer wave-lengths were comparatively more popular for patients with longer residence. As this same tendency distinguished adults from children, it appeared that patients, after the third year of hospital residence, corresponded more closely to children in their preferences than to adults. No significant differences existed in the preferences of the various diagnostic groups.

C. *Perceiving and Imagining.* 1. *Experiments.* Finding the reports of disordered patients inadequate for study of their perceptual products, a few investigators have attempted to devise other methods. Bender (**15**), working from the standpoint of Gestalt psy-

chology, presented schizophrenic patients and feebleminded persons of various mental ages with a group of Wertheimer's figures for copying. Considering the copies from the standpoint of such Gestalt principles as proximity of parts, continuity, and internal organization, she found the drawings of feebleminded persons similar to those of children. Schizophrenic patients also tended to reproduce the drawings in childish fashion, but they failed to exhibit tendencies typical for any particular mental age. In a study of the drawings of 8 patients with cerebral lesions, Bender (16) found again this tendency to revert to more primitive levels. In cases of recovery, successive tests as the patients improved resulted in drawings which tended to follow the course of developmental maturation. These results are interesting, but for study of perceptual products, this method is obviously complicated by muscular coördination and ability to draw.

Bender and Schilder (17) have investigated the reactions of 16 catatonic patients to the pain produced by strong induction shocks and pinching. These patients exhibited signs of their displeasure, but their defense was no longer integrated. Instead of pulling the injured part away, they merely frowned, cried or squirmed. It was as if some local disagreement were going on in the bodily sphere.

Schilder (156) has also obtained interesting results with the method of report. Hallucinations and eidetic images, he has pointed out, have the same "immediate self-presence" that characterizes objects perceived, while images and memorial reproductions do not. Rotation and other forms of vestibular irritation, he has found, also, may influence hallucinations and eidetic images just as they influence perceptual images. In hallucinations he has found parts of pictures which ordinarily remain in the background coming into the foreground, an effect which is sometimes obtained in normal persons by means of tachistoscopic exposures. He believes that these hallucinatory effects, which appear to have special significance, are determined by the patient's individual inner needs.

Bromberg and Schilder (29) have shown an interesting correlation between the normal observer's reports of tactual after-effects and the vasomotor phenomena produced by drawing figures on the skin of a catatonic patient who exhibited extreme vasomotor excitability. Tendencies for 2 points to connect, for the after-effects to wander toward such outstanding points in the body-image as the joints, and for sharp angles to be effaced appeared in the red lines made by marking the skin of a catatonic patient. This result and the fact that the tactual after-effects were frequently described by normal observers in terms of temperature qualities suggested that vasomotor effects might be involved in such tactual after-effects. Several of the tactual hallucinations of a case of alcoholic psychosis also contained many of

these tendencies. Bromberg and Schilder suggested that a hypersensitivity to such qualities might be the basis for the alcoholic's tactual hallucinations.

Street (170) has given his Gestalt completion test to a group of psychotic patients. This test consists in naming objects in pictures only partially drawn; thus the subject is required to fill in what has been omitted by the artist. While the scores of the patients were markedly inferior to those of comparable control subjects on this test, the scores gave no indication of the nature of the deficiency.

Recently Malamud and Linder (114) have shown how perceiving may be altered by a patient's inner needs. The primary purpose of their investigation was to test the contentions of the psychoanalytic theory of dreams. The subjects were 47 psychoneurotics, whose problems were fairly well known to Malamud. Linder presented the patients individually with copies of paintings. The patients looked at each picture for 30 seconds, with the instruction to observe it well so that they might describe it later. After some minutes of conversation about other topics, the patients were asked for the description. Two tendencies appeared in the descriptions given: (1) details were omitted, and (2) details were added. The patients were then told to write down all dreams occurring the following night. Malamud conducted the dream-analyses. In 16 of the 47 patients, aspects of the pictures which were left out or embellished in the descriptions, were subsequently shown to recur in their dreams. Confirmatory for analytic theory, these contents seemed to have relationship to scenes in the early life of the patients, and to be related to the problems which formed the central feature of their disorders. Malamud (113) has repeated the experiment with similar results. While fraught with many of the same difficulties of psychoanalysis as a method of science, this study represents an interesting attempt to bring some of the phenomena observed by analysts into a controlled situation.

Malamud and Nygard (115) investigated the rôle of cutaneous qualities in the perception of distance on the skin. They determined two-point thresholds and compared supraliminal distances, first, when the points merely touched the skin and, again, when they pressed the skin so hard as to be painful. Thirteen college students, 8 psychoneurotic patients, 1 case of psychopathic personality, and 4 schizophrenic patients served as subjects. For the students liminal distances subtended by pain were smaller than those subtended by pressure, but the reverse was true for the patients. Objectively equal distances on the skin were reported by all the students as smaller

when subtended by painful stimuli, while those subtended by pressure were reported as smaller by the patients. The reversal was substantiated. Malamud and Nygard related this striking reversal to a clinical theory of the neuroses. The psychoneurotic patient is supposed to acquiesce so completely to the "demands of the environment" that he disowns his own desires and represses any dissatisfaction arising from the conflict. From their experimental results they concluded: "This tendency toward repressing and compensating for subjective tendencies becomes a characteristic of the patient's whole personality".

2. *Summary and Criticism.* The description of perceiving and imagining in the disorders is scarcely begun. In fact, no summary of established facts can be made at present. There is evidence, however, that the factors governing the general behavior of patients are operative in their perceptual and imaginal activity. This provides a working hypothesis whereby the apprehending functions may be employed experimentally to uncover the functional trends which characterize patients. The studies by Malamud and Schilder are indicative, as the reviewer believes, of a fruitful trend in psychological research with psychotic patients. Their free usage of analogies and of the blanket concept of "personality", however, is unfortunate. Their experimental studies indicate certain specific trends in the operations of their subjects. These should be made as explicit as possible in terms of experimental conditions and performance.

D. *Statistical Studies of Hallucinations.* While statistical investigations of hallucinations in the disorders are not experimental, they furnish certain information about the apprehending functions and may therefore be included here.

Lind (110) found in manic-depressive patients that hallucinations occur more commonly in the male than in the female, and about twice as frequently in negro as in white patients. His sample of negroes, however, was too small to establish this ratio. Harrison (74) analyzed the hallucinations described in psychiatrists' accounts of the 'mental status' of 514 successively admitted patients. Hallucinations were described in approximately 40%. They were most common in schizophrenics (60%), rarer in manic-depressive patients (35%), and they occurred in only about one-fifth of patients with arteriosclerosis, senile dementia, and paresis. Auditory hallucinations were most prevalent, with the auditory-visual type second. Purely visual hallucinations were rare. The fact that visual hallucinations appeared most commonly among catatonic patients was interpreted to indicate that this type involves a more profound state of disorder than does the auditory type.

Bowman and Raymond (28) also found hallucinations more common in schizophrenics than in manic-depressive patients. They examined the descrip-

tions of the mental status of approximately a thousand schizophrenics and a thousand manic-depressive patients. Hallucinations appeared in 75% of male and in 81% of female schizophrenics, but they appeared in only 30% of the male and 37% of the female manic-depressive patients. Again auditory hallucinations were most prevalent.

E. *The Interpretation of Ink-Blots (Rorschach Method).* 1. *Experiments.* As Vernon has already reviewed the Rorschach method and its applications to the abnormal,[10] we shall mention briefly those studies in English.

Rorschach (153) compared what he could learn about a patient from his test with what a psychoanalyst had gleaned from the same patient in analysis. The agreement was striking. The analyst apparently could add only content derived from the patient's history.

Beck (13) gave the Rorschach test to 37 problem children. In only 3 of these did the psychogram seem to give an untrue picture of the child. The majority of the group exhibited signs of "constricted psychic potentialities", but others, whose interpretations involved movement and color, seemed primarily to lack self-control. Beck believed they had not developed any inhibitions.

Levy and Beck (108) tested approximately 40 cases of manic-depressive insanity, then retested them as their clinical condition altered. As patients changed from manic toward normal, the retests showed (1) increased productivity (more interpretations), (2) an increase in the number of details interpreted, (3) a decrease in the individuality of the interpretations, and (4) a tendency for the form of the blot to have more influence upon the color-interpretations. Opposite tendencies appeared in retests as patients changed in the direction of manic excitement. The psychograms derived from the test easily distinguished manic from depressed patients.

Beck (14) has begun the construction of a theory of personality from the results of the Rorschach test. In his view the test provides an indicator for 4 psychological forces in the organism which determine personality: (1) recognition of form, (2) organizing energy, (3) creative ability, and (4) affectivity. The environment he considers a fifth determinant of the personality. With this theoretical

[10] Vernon, P. E., The Rorschach Ink-Blot Test. *Brit. J. Med. Psychol.*, 1933, 13, 89–118. For the standard description of the method, see: Rorschach, H., *Psychodiagnostik: Methodik und Ergebnisse eines Wahrnehmungsdiagnostischen. Experimente.* Bern: Bischer (also Huber), 1921. Pp. 174. See, also, Hertz, M. R., The Rorschach Ink-Blot Test: Historical Summary. *Psychol. Bull.*, 1935, 32, 33–66.

structure Beck has begun to systematize the psychological changes occurring in the psychoses.

2. *Criticism.* The Rorschach method affords interesting possibilities for determining the functional trends which characterize a person's psychological activity. So far, however, there has been too little careful research with the method. In its present state the test requires too much of divination and intuition. More objective ways of classifying the interpretations are needed. Considerable validating must be done before the test can be meaningfully applied.

VI. Investigations of Verbal Sequences

A. *Free Association.* 1. *Experiments.* After Jung (**95, 96**) introduced his use of free association as a method of uncovering 'complexes' into America, a number of investigators employed it immediately for work with disordered patients.[11] Kent and Rosanoff (**103**) standardized an association test for clinical and experimental purposes. They obtained the responses of 1,000 normal subjects to 100 stimulus words and tabulated them in a frequency table. After standardizing their list (Kent-Rosanoff list), they gave it to psychotic patients who gave a larger percentage of 'individual' responses (average 50%) than did normal persons (average 6.8%). The differences, however, were not sharply defined. Kent and Rosanoff wrote, "Thus the test records of dementia praecox depart from the normal not sharply but by gradual shading off. By application of the association-test, according to the method here proposed,

[11] The history of this method is often garbled. Free association and its use for "uncovering the uncharted depths" was probably first described by Galton (Psychometric Experiments. *Brain*, 1879–1880, **2**, 149–162). It was common in Wundt's laboratory when Freud took it over as a clinical tool. Jung advertised the method and in his *Studies in Word Association* (**97**) approached what may be called an experimental application of it to the study of disorders. This latter work is well known; it cannot be reviewed here for it would require much more than the available space. Suffice it to say that it was largely from objective results and divinations gleaned by this method that Jung built his psychological theories of the unconscious, of types, and of dementia praecox. These are all available in translation as follows: Jung, C. G., *Psychology of the Unconscious.* (Trans. by B. M. Hinkle.) New York: Dodd, Mead & Co., 1925; *Psychological Types or the Psychology of Individualism.* (Trans. by H. G. Baynes.) New York: Harcourt Brace & Co., 1923; and *The Psychology of Dementia Praecox.* (Trans. by F. Peterson and A. A. Brill.) *Nerv. & Ment. Dis. Monog. Ser.* No. 3. New York: J. Nerv. & Ment. Dis. Pub. Co., 1909.

no sharp distinction can be drawn between mental health and mental disease" (**103**, p. *72*).

In an early examination of some 12,000 associations, obtained with a list comparable to Jung's, Wells (**187**) found the quickness of the response depending upon the following factors: (1) the tendency for the associations to be presented in linguistic or imaginal form, (2) the relative preponderance of some single association, (3) the willingness or unwillingness of the subject to utter the response which presents itself, and (4) such direct inhibitory effects as are induced by any strong emotional reaction. From observer's reports he found that associations with a special complex need not be slow, and that factors unassociated with emotion may effect lengthened times.

Wells (**189**) gave the Kent-Rosanoff list to 21 patients with schizophrenia and manic-depressive insanity. While he found such tendencies as lengthened association times for most patients, a decrease in the proportion of common responses for schizophrenics, and increased "commonality" accompanying improvement from manic-depressive states, Wells concluded that the associative reactions should be sought in mechanisms common to both normal and pathological psychology, since they differ less than do vital adaptations.

Murphy (**122**, **123**) conducted 2 investigations of the word associations of dementia praecox and manic-depressive patients. Instead of following Jung's method, Murphy classified the responses according to their logical relation to the stimulus words. Although there appeared significant correlations between certain types of associations in one psychosis which did not exist in another, no single type of association was typical of any diagnostic group or of normals. Murphy agreed with Kraepelin who had written that "the association-experiment strikes chiefly at the crystallization of the habits of speech, which are for the most part little influenced by the disorders".

Tendler (**177**) found the responses of 50 psychoneurotics to the Kent-Rosanoff list falling into 2 types. The responses of one type were similar to those found in adults while those of the other type were similar to the responses of children. Tendler suggested that the difficulties of patients of the former type might have arisen from life situations while those of the latter type resulted from constitutional inferiority.

Rosanoff, Martin, and Rosanoff (**154**) attempted to devise a free-association test which could be applied to estimate higher ranges of "mental capacity". They standardized a list of words by giving it to a large group of individuals whose educational status varied from illiteracy up through college and finally to 100 men listed in *American Men of Science*. The associations of non-psychotics were influenced by education up to but not beyond the first year in college. The scores of manic-depressive patients approached the normal, with

schizophrenics, patients with paranoid conditions, and epileptics following in order.

2. *Summary and Criticism.* Two general conclusions may be drawn from these experimental studies with free associations: (1) The disorders alter very little the speech habits of patients as shown by the fact that relationships between stimulus words and response words are unchanged in patients. (2) Disordered persons give a larger proportion of 'individual' responses, indicating that they are out of touch with normal discourse.

While the method of free association is undoubtedly useful as an aid to clinical divination, it is too blunt to become a useful tool in experimental research. Too few of the conditions in the setting are even known. None is controlled.

B. *Parts of Speech Used by Psychotic Patients.* McDonald (**118**) wrote down successive words produced by 10 manic-depressive, 10 schizophrenic, and 10 paretic patients. For 10 patients from whom he got 500 consecutive words each, McDonald tabulated each part of speech and compared these with similar tabulations from the writings of normal adults and of children. No patient used as many different words as the child with the poorest vocabulary. The proportion of nouns was reduced to almost half that used by adults and children, while that of verbs was increased by about one-third. The patients used fewer articles than either adults or children, but the proportions of pronouns and adverbs were high. Adjectives were used less frequently than by adults, but more frequently than by children. In view of these gross differences and the placing of various parts of speech in different areas of the brain, McDonald suggested that such an analysis might be elaborated and employed as a diagnostic technique. He failed to discuss psychological implications.

VII. Investigations of Emotional Phenomena

Psychopathologists have long believed that the emotions of psychotic patients are deeply involved in the genesis of the disorders. But as the emotions have generally resisted the efforts of experimental psychologists, and as the James-Lange theory was long in vogue, most experimental investigators have attacked this function in the disorders by way of physiological indicators.

A. *Studies of Circulation and Respiration.* 1. *Experiments.* DeBruyn (**42**) endeavored to determine whether schizophrenics were really as "obtuse" emotionally as their behavior would indicate. Using the Sumner pneumograph and a finger plethysmograph with 11 catatonics, his records indicated that these changes in respiration and blood-pressure occurred in 121 of 177 experiments on these patients. It made little difference which modality was

stimulated. DeBruyn concluded that the unresponsiveness of these catatonics was confined to the striped muscles.

Coriat (**35**), stimulating with pin pricks, startling noises, and 'critical' words, found again that schizophrenics who appeared to be utterly apathetic exhibited accelerations of the pulse comparable to those of his normal subjects. Pollock and Dallear (**134**) also obtained with the pneumograph what were considered to be emotional responses in schizophrenic patients.

Gordon (**69**) has observed rises and falls in the records of blood-pressure in patients which were correlated with "distinct modifications of the patient's attitude, behavior, and his mode of feeling and thinking".[12]

2. *Summary and Criticism.* That patients, apparently apathetic, react physiologically to stimuli which ordinarily evoke emotional responses appears fairly well established. Considerable research must still be done, however, before the psychological significance of these indicators is understood.

B. *Electrical Phenomena of the Skin.* 1. *Experiments.* Landis and DeWick [13] and Landis [14] have already reviewed all but the most recent studies of the electrical phenomena of the skin in 2 well known reviews. In order to make our own bibliography complete, however, we include the titles reviewed there. Since Landis' last review several more investigations have been published.

Landis and Forbes (**105**), in a systematic comparison of various methods, have shown that curves of basic resistance obtained from catatonic patients and normal subjects during normal sleep vary with the location of the skin-area and the electrical technique used. Forbes and Piotrowski (**55**) measured the resistance of the skin in 10 catatonics and 4 normal subjects during 4 nights of normal sleep (Richter method) finding that catatonics exhibited a greater percentage than the normals of records in which variations in resistance of

---

[12] Medical and physiological studies touching upon emotional phenomena by way of these indicators may be obtained from the bibliography in the study by H. Freeman, The Effect of "Habituation" on Blood Pressure in Schizophrenia. *Arch. Neurol. & Psychiat.*, 1933, **29**, 139–147.

[13] Landis, C., and DeWick, H. N., The Electrical Phenomena of the Skin (Psychogalvanic Reflex). *Psychol. Bull.*, 1929, **26**, 64–119. In this review the following applications to the disorders are to be found: Abbot and Wells (**1**), Golla (**68**), Jung (**95**), McCowan (**117**), Peterson (**130**), Peterson and Jung (**131**), Prince (**140**), Prince and Peterson (**143**), Prideaux (**139**), Richsher and Jung (**152**), Richter (**147, 148**), Syz (**172**), and Wells and Forbes (**195**). *Cf.* pp. 98–101.

[14] Landis, C., Electrical Phenomena of the Skin (Galvanic Skin Response). *Psychol. Bull.*, 1932, **29**, 693–752. Here are reviewed the following papers: Richter (**149, 150**), Syz (**173**), Syz and Kinder (**174, 175**), Westburgh (**201**), Westburgh and Eyman (**202**).

more than 20,000 ohms occurred. This finding indicated that a greater minute-to-minute variability of the autonomic function probably exists in catatonics. Whether such variability is characteristic of other psychotic patients they could not state.

Porter (135) has found the skin-resistance of epileptics lowered during seizures, the lowest value appearing at the cessation of the clonic phase. He also found a higher resistance in epileptics not in seizure than in normal subjects.

Ödegaard (125), using a string galvanometer with no external current, has shown that the records of continuous galvanic reactivity from patients differ from those of normal subjects in 3 ways: (1) decreased reactivity, (2) unstable reactivity, and (3) the positive component is decreased with the negative component normal. Factors found to be related to decreased reactivity were: age above 40 years, depression, katathymic pictures, high and unstable pulse rate, and undernourishment. Correlated with unstable reactivity were: youth (under 30 years), anxiety and tenseness, body complaints, irritability, and manic excitement. With a decrease in the positive component went anxiety and tenseness, restlessness and agitation, symptoms pointing to organic lesion of the brain, and depression. Since the negative component is of short latency, is independent of the nature of the stimuli, and is not decreased in agitated cases where the positive component is absent, Ödegaard considered that the negative component probably represents the subcortical activities; while cortical activities he considered to be represented by the positive component.

Solomon and Fentress (166) have related the resistance of the skin and blood-pressure measurements in 67 neurotic patients to the observed manifestations of certain Freudian concepts. Low resistance and low absolute galvanic reactions appeared in anxiety states where there is supposed to be a large amount of "free energy". High resistance and high absolute galvanic reactions occurred in patients with hysteria and compulsive symptoms, where energy is supposed to be "bound".

Using similar concepts and techniques, Darrow and Solomon (39) registered galvanic reactions and blood-pressure changes to a series of stimuli varying from indifferent clicks to statements calculated to have emotional value. In the 50 patients of this investigation, no correlation appeared between diagnosis and the objective data. But when these galvanic and blood-pressure data were related to ratings of the patients with regard to state of nourishment, "insight", "free or bound energy", and the like, the following relationships appeared:

(1) Poorly nourished patients tended to give smaller galvanic reactions and smaller blood-pressures. (2) Patients with little 'insight' and poor attention tended to show high skin-resistance but small galvanic reactions to sensory and ideational stimuli. (3) Large increases in blood-pressure after ideational stimuli appeared in patients rated high in "defense" and "projection" tendencies. (4) Those patients rated as having a large amount of "free energy" (anxiety) tended to exhibit low skin-resistance. Darrow and Solomon considered the relationship between exaggerated "defense" mechanisms and large rises in blood-pressure to be more than coincidentally connected with Lewis' finding of enlarged hearts and aortas in paranoid patients.[15] "Free energy" was biologically viewed as mobilized in the anticipation of a need, but having no outlet in an adjustive process. Thus, the electrical resistance of the palm may be significant (1) "as an index of the extent of mobilization of the organism in general and of the vegetative system in particular in anticipation and preparation for new adjustments, and (2) as an indication of the degree to which energy (heat?) production in the body exceeds the facilities for its dissipation by other means than sweat secretion".

Lockwood (111) has found coincident and parallel variations of galvanic reactivity with the hyperglycaemic index in manic-depressive and dementia praecox patients.

2. *Summary and Criticism.* Landis pointed out that most of the work on the electrical phenomena of the skin is riddled with contradictions. The attempts to employ these phenomena as indicators of emotion were premature. Only recently have the biophysics of the phenomena begun to become clear. Landis believes, however, they may still be useful "to demonstrate pathological states within the autonomic nervous system and possibly to indicate the level of nervous reactivity of an individual".[16] The recent attempts to correlate these electrical phenomena with clinically observed characteristics of patients instead of diagnoses is good sense, and they appear to constitute a fruitful avenue of investigation. Such concepts as "free" and "bound" energy employed by Darrow and Solomon, however, are dubious, and might better be discarded in favor of

[15] It would appear that abnormalities of psychological functioning may possibly result in anatomical changes.

[16] Landis, C., Psychiatry and the Psychogalvanic Reflex. *Psychiat. Quart.*, 1932, **6**, 262–272.

descriptions of what is actually observed. Let the theory of what is observed develop from the implications of experimental results.

C. *Investigations of Emotion with Tests.* Olson (126) was able to find nothing of significance in the performances of psychotic patients on the Pressey X-O test.

Ball (9) found what he considered marked differences in the performance curves on a learning test of emotionally stable and unstable problem children. As is typical of persons in disorder, the unstable children exhibited more variability in their successive performances.

VIII. Investigations of 'Personality' in the Disorders

Loose common-sense term that 'personality' is, it is prevalent in the fields of psychology and psychiatry. Investigations of various traits in the disorders fall correctly under it.

A. *Introversion-Extraversion.* Investigators have attempted to obtain an objective and quantitative statement of Jung's personality types. The method has consisted traditionally of the administration of a questionnaire.

Since manic-depressive insanity and dementia praecox have, in certain prevalent but loose clinical theories, been considered the extremes of the introversion-extraversion continuum, Neymann and Kohlstedt (124) and Gilliland and Morgan (67) have attempted to validate tests for these traits by selecting statistically items or questions which distinguish these diagnostic groups. On the other hand, Campbell (32) gave Heidbreder's adaptation of Freyd's list to dementia praecox and manic-depressive patients in order to test the theory. The tautology is obvious. Campbell found not a bi-modal distribution but one having the general bell-shaped form.

Hunt and Guilford (86), employing similar logic, determined the rates of fluctuation of an outline cube for manic-depressive and dementia praecox patients in order to test McDougall's theory that introversion and extraversion are manifested respectively in high and low rates. Dementia praecox patients showed an average rate about 4 times that of the manic-depressive group, and this ratio increased to 6 to 1 when instructions were given to inhibit the fluctuations. As the dementia praecox group was similar to a normal group in average rate and in dispersion, something in the make-up of the manic-depressive was considered to have inhibited the fluctuations. Although this study was rooted in poor theory, the performances of these two groups of patients exhibited such a marked difference that fluctuating perspective in ambiguous figures deserves further exploitation.

B. *Neurotic Traits.* 1. *Experiments.* Smith (164) found that manic-depressive patients gave an average of 20% more neurotic answers on *Thurstone's Neurotic Inventory* than did a comparable group of schizophrenics. Papurt (129) found the number of neurotic

answers on *Woodworth's Psychoneurotic Inventory* ranging as low as 6 in a case of Huntington's chorea and as high as 48 in epileptics. He considered a revision of the scale was required. Yu (**209**) obtained on Bernreuter's test more answers indicating introversion, neuroticism, and submissiveness from schizophrenics than from manic-depressive patients. Normal individuals gave fewer submissive and neurotic answers and more answers indicating self-sufficiency than either group of patients.

Zubin (**210**) has begun a statistical analysis of the association among the answers of psychotic patients on the various items in several of these inventories.

Page, Landis, and Katz (**128**), testing the theory that a patient's "total personality" is basic in his type of disorder, put into a questionnaire a list of 50 traits selected as schizoid by at least 8 of 10 psychiatrists. While there were qualitative behavioral differences in the interest shown in the test, normal subjects, schizophrenics, and manic-depressive patients all exhibited about the same average number of schizoid traits by their answers. These investigators concluded that "either the questionnaire is not a valid way to check the hypothesis, or the hypothesis is incorrect".

2. *Summary and Criticism.* Results from questionnaires would indicate that psychotic patients have few more neurotic traits than the average person. The questionnaire, however, is an especially crude method for work with disordered persons. There is no reason to believe that a patient will answer a list of written questions about himself honestly. If he did answer them to the best of his ability, there is no reason to believe that he can report such things about himself as many of the questions ask. The interview is less objectionable, for there the interviewer, if he is skillful, may approach critical points by indirection.

C. *Reaction to Success and Failure.* Hausmann (**76**) has devised an ingenious method to test variations in reaction to success and failure. The patient is required to predict his score in a game of throwing darts at a target, making his prediction for the next trial after each successive performance. When he falls below his prediction he is penalized, but he gets nothing for exceeding it. After about 30 trials the patient's predictions and scores can be plotted, giving an objective picture of his mode of making adjustments. Hausmann described 4 types of abnormal reaction: (1) adjustments determined entirely by the last result without consideration of the general trend, (2) a high contract clung to no matter what the objective scores indicate (typical of paranoid patients), (3) becoming so greatly concerned with a slight raise of the contract that performance is shattered, and (4) irrational adjustments, *i.e.* raising the bid after failure

and lowering it after success (common in schizophrenic patients). Well-adjusted students exhibited only slight discrepancies between their predictions and their performances.

D. *Summary of Investigations of Pre-psychotic Personality.*[17] The investigations of pre-psychotic personality have been done to test Jung's theory that constitutional make-up determines the form of psychosis. They depend upon a statistical analysis of information gleaned by social workers from relatives and acquaintances of the patients. The method has ordinarily been to determine whether the traits characterizing the psychosis were manifest before the onset of disorder.

Seclusiveness or a tendency to be 'shut in' which characterizes schizophrenics has been found by Hoch (**79**), Bond and Abbot (**22**), Bowman and Raymond (**26**), and Blalock (**21**) to be manifest before the onset of psychosis in only from 20% to 57% of the schizophrenics examined. This trait has also characterized the pre-psychotic personalities of 4% and 33% of manic-depressive patients in the studies by Bond and Abbot (**22**) and by Bowman and Raymond (**26**) respectively. Hoch (**79**) found 44% of the manic-depressive patients in his study manifesting exaggerated emotional tendencies before the onset of disorder. 'Normal' personalities, on the other hand, have appeared in 18% (Hoch, **79**) and 27% (Bowman and Raymond, **26**) of schizophrenic patients; in 35% (Bowman and Raymond, **26**) and 86% (Bond and Abbot, **22**) of manic-depressive patients; and in 62% (Bowman and Raymond, **26**) of paretic patients. Kasanin and Rosen (**98**), after obtaining results similar to these mentioned, concluded that the method was inadequate, that a tabulation of traits cannot give "a true picture of the personality or of its dynamic relation to the psychosis".

From extensive histories of 25 cases of paresis, Osnato (**127**) found that those who had been well adjusted members of society before the onset of the breakdown manifested in disorder only memorial defects, some deterioration, and various physical symptoms. On the other hand, those who had had neurotic temperaments and been inefficient workers manifested predominantly such mental symptoms as euphoria, explosiveness, and extreme excitability. The method has been apparently fruitful only in this instance.

IX. Tests for Clinically Observed Characteristics

A. *Suggestibility and Negativism.* After finding auditory thresholds raised for some subjects and lowered for others under crystal gazing, Travis (**178**) employed the method with patients, assuming

[17] As these studies are not truly experimental, no special effort has been made to make the list complete. Here are mentioned those investigations which have come to the writer's attention in the course of this study. Space prevents individual discussion.

that the extremes of suggestibility and negativism were represented by hysteria and schizophrenia respectively. When the thresholds were lowered for all hysterical patients and raised for all schizophrenics under crystal gazing, he concluded that the technique distinguished the suggestible from the negativistic. Travis (**179**) then applied the method blindly to 59 patients to find again almost perfect discrimination between schizophrenics and psychoneurotics, with other diagnostic groups exhibiting both raised and lowered thresholds. The phenomenon was attributed to some difference in the central sets distinguishing psychoneurotics from schizophrenics, and Travis recommended the technique for diagnostic purposes. R. C. Travis (**182**) repeated the study with both auditory and visual thresholds, and obtained equally remarkable results. As the predictive value of the auditory test was somewhat higher, he considered it the better method of the two.[18]

Williams (**203**) obtained positive responses (backward sway) to the suggestion: "You are falling backward", from catatonics (10%), paranoids (54%) and manic patients (28%). He got no response from 30% of the catatonics, 46% of the paranoids, and 58% of the manics. Negative responses appeared in 59% of the catatonics, none of the paranoids, and 14% of the manics. Negative responses from more than half of the catatonic group parallel the psychiatric observation of negativism in this group.

Allen (**3**), using "auto-suggestion" as a reinforcement to psychoanalysis, has demonstrated marked changes in behavior by having his patients repeat a sentence calculated to represent some aspect of their conflicts.

B. *Perseveration.* Psychopathologists have long noted the tendency for certain types of psychotic patients to repeat phrases or motions over and over, and the tendency has been known as 'perseveration'. Wells (**188**) obtained laboratory evidence of this characteristic when he found "overmarking" characteristic of the performances of psychotic patients on cancellation tests.

Jones (**94**) gave a battery of perseveration tests to depressed patients (supposed to be perseverators) and to manics (supposed not to perseverate) in order to determine which functions are most marked by perseveration. The battery included: (1) sensory tests, involving (a) the time required to distinguish a dim light after being subjected to a bright one, and (b) the speed at which 2 colors appear in a color wheel descending from high speed revolution; (2) motor tests in which the subjects were required to write letters

[18] A study by Bartlett (The Auditory Threshold in Reverie. *Arch. of Psychol.*, 1935, **27**, No. 182. Pp. 42.) and another by Dahms and Jenness, done at the University of Nebraska, have both failed to verify these results.

forward and backward and to make patterns of strokes; and (3) ideational tests in which they were required to name objects or animals as rapidly as possible for one minute. In the sensory and motor tests both manic and depressed patients were more perseverative than control subjects. No correlation appeared between these results and those from ideational tests. The latter distinguished manics from depressed patients, these 2 groups being respectively above and below the controls in the number of objects named. Ewen (**50**) gave Jones' tests to a group of psychotic epileptics, and found them much more perseverative than control subjects in all three types of performance.

Spearman and his followers view perseveration or '*p*' as one of the principal variables of individual difference. Stephenson (**167**) introduced Spearman's *X–Y* tests for measuring perseveration into psychopathology.

These tests are motor tests of perseveration. They consist of 3 trials of habituated activity (X-activity) done as rapidly as possible for 30 seconds, then a trial at reversing the habituated activity (Y_1-activity), and finally a trial of alternating the habituated with the reversed activity (Y_2-activity). Patterns of strokes and the letters *Z*, *W*, and *E* are commonly employed. The *p*-score is obtained by dividing the average number of X-forms, written in the 3 trials, by the number of Y_1 and of Y_2 forms written, and summing these proportions, *i.e.* *p*-score$=X/Y_1+X/Y_2$. One case of schizophrenia exhibited an extremely high *p*-score. Stephenson (**168**) gave these tests to a group of patients representing several diagnoses to find that high *p*-scores accompanied marked "mental deterioration" regardless of diagnosis. *P*-scores of manics were low, those of depressed patients high. Schizophrenics fell into 2 groups, one with high *p*-scores and another with scores lower than the average for normal subjects. In order to find the correlates of the high *p*-scores in schizophrenic patients, Stephenson (**169**) gave the tests repeatedly to 27 of this group. The scores were found to be highest in inaccessible patients, and were observed to change with accessibility. Cameron and Count (**31**) have also given the X-Y tests to psychotic patients, but their results led them to the conclusion that the method was still too imperfect to be a useful tool.

Mays (**116**) has attempted to determine whether perseverative tendencies are demonstrable on the autonomic level. Starting with the observation that catatonic patients are typically perseverators, he subjected a group of them and a comparable group of controls to repetitive patterns of bells and buzzers and obtained a continuous record of the galvanic skin response. The degree of apparent perseveration was determined by comparing the deflections in the later with those in the earlier parts of each experimental session. By several modes of calculation the catatonics showed more perseveration than did the controls.

Shipley (161) continued Mays' work, working with manic-depressive and psychoneurotic patients as well as catatonics. He employed (1) resistance to adaptation, (2) the degree of conditioning, (3) the degree of irradiation to non-reinforced stimulus patterns, and (4) resistance to experimental extinction as evidences of perseveration in the galvanic skin response. The catatonics ranked highest in the first 3 indices, but they fell lower than the other groups in the last index. All psychotic groups ranked somewhat higher than the control subjects.

C. *Central Control of Cerea Flexibilitas.* Landis, Forbes, and other workers in the psychological laboratory at the New York Psychiatric Institute and Hospital have done a series of studies of the clinically observed characteristics of catatonic patients. The studies of perseverative tendencies (Mays, 116, and Shipley, 161) and of the electrical phenomena of the skin in catatonics (Forbes and Piotrowski, 55), already mentioned, belong to this group. Forbes (54) made a photographic analysis of the movements of catatonics during sleep. Cerea flexibilitas was observed to disappear with the onset of sleep in all 5 catatonics who exhibited this state during waking. The motility of 2 cataleptic patients, which was extremely low during waking, increased during sleep, approaching, but not reaching, the range of motility expected from normal sleepers. Eight non-cataleptic catatonics gave records comparable to those of healthy subjects. Forbes concluded that activity of either cortical or lower brain centers must be responsible for the occurrence of cerea flexibilitas, and that any attempt to explain the state must provide a mechanism to account for the quick reversibility observed at the onset or end of sleep.

DuBois and Forbes (47) analyzed the postures in the photographs of their sleeping catatonics in order to determine whether 'foetal' poses occurred more frequently in catatonics than in normals as would be assumed from Kempf's theory of regression. Curled or 'foetal' postures, however, constituted less than 10 % of the postures assumed by the patients. Less than 7% of their sleeping time was spent in the curl. Two patients, who maintained extremely curled positions during the day, took a normal range of positions during sleep. These results were interpreted as indirect evidence against Kempf's theory.

D. *Psychological Changes in Paresis.* Landis and Rechetnick (107) tabulated the results of the psychiatric examination, made by the standardized procedure of Kirby, for 100 cases of paresis treated with radiotherm pyrexia or malaria. Retention and immediate recall showed the most impairment, and 90% of the group exhibited this form of loss. Changes in the efficiency of paretics in this type of per-

formance also assumed an important rôle as an index of improvement. If after treatment the patient's memory improved, then in 46 cases of the hundred, the patient was discharged as improved. When treatment did not improve retention and immediate recall, in 42 cases the patient was discharged as unimproved, and in only 8 cases as improved. No such relationship appeared between prognosis and any other form of impairment. In conclusion, Landis and Rechetnick wrote, " We might say that as retention and immediate recall go, so goes the improvement ".

DuBois, Mays, and Landis (**48**) gave a large battery of tests to paretic patients before and after treatment with pyrexia or malaria. Considerable improvement after therapy appeared in scores on the Army Alpha test, on tests of motor coördination, and in speed of tapping. While some of this improvement was considered due to learning, practice, and increased coöperation, there was still evidence that these treatments result in improved capabilities.

E. *' Thinking Difficulties '.* The formal thinking difficulty is a symptom commonly mentioned in psychiatric discussion. It consists generally in failure to sustain a topic in logical order and in failing to note obvious inconsistencies in the delusional system. Hausmann (**77**) has assembled a battery of tests to demonstrate the presence of formal ' thinking difficulties '. The battery includes a substitution test, to be given for spontaneous speed, the arithmetical progressions from the Army Alpha, and a narrative containing a number of absurdities. Those patients who require longer than 15 minutes for the substitution test, or who can do less than 12 of the arithmetical progressions are considered to have an intellectual capacity below that required for noting the absurdities. Patients who fulfill these requirements and fail to note the absurdities are considered to be suffering from a ' thinking difficulty '.

This test of Hausmann's is an example of what may be done in the way of devising tests for psychiatric concepts. Once such a procedure is devised, concepts like that of ' thinking difficulty ' lose their attractive vagueness, and come to be defined by the operations in the test.

In an attempt to understand better this so-called formal thinking difficulty, Hunt (**85**) has employed Hausmann's narrative in conjunction with a list of graded arithmetical progressions. In solving progressions paretics proved considerably less efficient than schizophrenics, many of whom did nearly as well as the normal controls. Here the direction of the performance was inherent in the progression placed before the subject. On Hausmann's narrative the paretics proved more efficient than the schizophrenics who noted no absurdities

before being instructed to look for inconsistencies. Thus, for the schizophrenics, the defect appeared to result either from a want of governing factors (probably self-instructions) which normally take the place of the warning to watch for inconsistences, or from a failure to ligate the separate statements. While this work stands at an early stage, the approach appears promising.[19]

X. Miscellaneous Topics of Investigation

A. *'Introspections' of Psychotic Patients.* Boring (**25**) obtained "systematic introspections" (descriptions of the imagery and cues employed) from 8 schizophrenic patients during the learning of a pencil maze. Comparing these reports with those from 3 trained observers and 2 normal boys, he found them containing more irrelevant material, and poorer phraseology than those of the boys, yet they sufficed to indicate the "general trend of consciousness". In a study of the conscious correlates of the galvanic skin reflex, W. A. Hunt and Landis (**88**) found that schizophrenics reported very little material.

B. *Instruction of Psychotic Patients.* With the possibilities of reëducation in view, Kent (**102**) studied the technique for getting uncoöperative patients "to do anything at all", and developed a useful set of rules.

Wells (**188**) has found with the Woodworth and Wells directions tests that schizophrenics follow formal instructions poorly. On the 'hard directions' test, only one patient fell within the normal limits of performance.

C. *Statistical Analysis of Syndromes.* Moore (**121**) has obtained measures of emotional manifestations, of reasoning, of perception, of the span of memory, and of the rate of forgetting from 367 manic-depressive and dementia praecox patients. With these he combined a record of the presence or absence of a long list of symptoms. The list of factors, numbering 41, was intercorrelated, and Spearman's criterion of tetrad differences was applied to discover group factors. Eight such factors appeared: (1) cognitive defect, positively related to the praecox conditions and negatively related to manic-depressive insanity, (2) the catatonic syndrome, considered the inhibitory phase of dementia praecox, (3) a kinetic syndrome, probably the excited phase of schizophrenia, (4) a non-euphoric manic syndrome, also a phase of schizophrenia, (5) an euphoric syndrome underlying the manic condition, (6) a syndrome of delusions and hallucinations which appears in both groups, (7) constitutional depression, an hereditary factor which attacks the controlling mechanism of emo-

[19] Hunt, J. McV., Psychological Loss in Paretics and Schizophrenics. *Amer. J. Psychol.*, 1935, **47**, 458–463.

tional life but leaves the cognitive factors untouched, and (8) a syndrome of retarded depression which was not clearly differentiated. This approach is hard to evaluate. The establishment of definite syndromes of symptoms by statistical means would be important for the revision of existing diagnostic categories, however, and should lead to fruitful experimental problems.

D. *Miscellaneous.* Morton Prince (**140, 141, 142**) has published a series of investigations of Miss Beauchamp, his case of multiple personality, to illustrate and substantiate his theories of the unconscious, the subconscious, and the co-conscious.

Franz and Hamilton (**62**) have found that exercise given with a mechanical vibrator lowered sensibility to pain and increased the speed of tapping in 2 depressed patients.

McFarland (**119**) has measured the loss of functional capacity due to oxygen want in neurasthenic patients and normal subjects. His control subjects were deprived of sleep for 36 hours to make them comparable to the neurasthenic patients in whom manifestations of fatigue were prominent. After a practice period, each subject was given a battery of 8 tests in 12%, 10.5%, 9%, and 50% concentrations of oxygen. The neurasthenic patients were affected more quickly at 12% and especially at 10.5% concentrations of oxygen than the normal subjects. The improvement of the psychoneurotics was also greater than that of the normals in 50% oxygen, thus indicating some relationship between oxygen want and fatigue in neurasthenia.

In an attempt to refine the method of testing pupillary reaction Cutting (**38**) has observed the effects of a series of blue, green, red, yellow, and white lights of 4, 8, and 16 candle power on the pupils of a large group of psychotic patients of varied diagnoses. The widest dilation was produced by white light, with yellow, reddish, green, blue, and violet following in order. No reaction specific to the various disorders appeared.

Gardner (**63**) has equated various bits of psychotic behavior to the behavior of children at various age levels in order to formulate a standard of comparison for use in stating the limits of regression. From his schedule (worked out to 30 months) a 'psychotic age' is obtained.

XI. Conclusion

To the reader of this review it will be obvious that psychology has made only a beginning with the disorders. We have here, to be sure, a fairly large number of experimental and semi-experimental studies that belong in the textbooks, but the results are too few and too patchy to permit the formulation of an empirical psychology of the disorders.

Mere mention of the standards for an experimental investigation given in the introduction to this paper allows the defects in the majority of these investigations to stand out. Only occasionally have the psychological aspects under investigation been isolated by experi-

mental control. Failure of isolation has frequently made the statistical treatment of data almost meaningless. Lack of systematic psychological orientation is manifest in the patchiness of the results.

Although much is wanting in these studies, they do constitute a beginning. Fortunately they hold several admonitions to investigators in the future.

Following the trend of the times, which manifested itself in the emphasis on individual differences, too many investigators have been interested primarily in the capacity and efficiency of psychotic patients. Results of the investigations from this standpoint, as the investigators have acknowledged, were complicated by the uncoöperativeness of disordered subjects. In viewing this uncoöperativeness merely as an obstacle to research, psychologists have missed, as this writer believes, many of the key problems. Especially important are the disordered person's relationships to his fellows, his changed view of himself, and of the world, and the influence of these views upon his operations. Finding methods for experimental research of this kind, to be sure, is difficult, but when problems are squarely faced methods appear.

Almost blind acceptance of existing nosology has also been an unfortunate tendency. All too frequently this has led to the vain hope of supplying the psychiatrist with rule-of-thumb diagnostic tests for his own categories of disorder. As most of these diagnostic categories have been derived from rough clinical observation of gross symptoms, usually without even statistical check, they should not remain dogma. The experimental psychologist must proceed critically in his use of diagnosis. He should attack problems independently, achieving his own psychological classification inductively from experimental results.

If a true psychology of the disorders is to be developed, and if the psychologist is to make his contribution to the understanding of the disorders, he must proceed systematically. Too frequently in the past, psychological investigations have been done 'here and there' with little or no systematic orientation. Almost as unfruitful as no orientation has been the search for loss in specific faculties or powers. Two factors appear to account for this haphazardness and for the persistent refusal to leave a cul-de-sac. First, too few men with training in and a talent for experimental psychology have worked consistently in the abnormal. One need not use all the fingers of the right hand to count the experimental psychologists who have given 20 of their years to research in the disorders. Secondly, the systematic psychologies of the past have not been applicable to the abnormal.

These failures are not, however, an indictment of the psychological profession, for the opportunity to do research in this field has not existed in any extent until very recently. Had more competent men worked consistently with disordered patients both psychology and psychopathology would have profited.

Now that the challenge of mental disorder is finally being accepted by men in the sciences of life, psychology may contribute in several directions. Investigations of experimental neuroses in animals by way of the conditioning methods should contribute much to an understanding of the etiology of the functional disorders. In fact, it may be necessary to go to animals to discover the bare fundamentals. Development of good techniques for research in the emotions would be a tremendous advance for research in the abnormal. Long studies of psychological development in children, especially from the standpoint of their social and family relationships and the manner in which these relationships function in the production of their socialized self-objects, should be extremely fruitful. Such studies should supply the information necessary for interpreting, in human terms, the conditions employed in getting neuroses in animals. Work with psychotic patients, which has been the field of our inquiry, has still considerable to offer. Here, to mention certain avenues which appear promising to the writer, the psychologist can make a systematic organization of the functional trends which differentiate the disordered from those called normal. Let him consider immediately the obvious differences such as the disinterested uncoöperativeness of schizophrenics. Let him set up experimental situations which will define these differentiae, *i.e.* that will uncover the conditions of the uncoöperativeness. Frequently, the psychologist will obtain indications from his experimental controls as to the nature of the governors of the functional aberrations. In the search for the governors, he may also join in coöperative studies with men of endocrinology, physiology, and neurology, or with the therapist. For future investigators we hope that our review of past work may be of service.

BIBLIOGRAPHY *

1. Abbot, E. S., and Wells, F. L., Psychogalvanism in the Observation of Stuporous Conditions. *Psychol. Rev.*, 1919, **26**, 360–366.
2. Achilles, E. M., Experimental Studies in Recall and Recognition. *Arch. of Psychol.*, 1917–1921, **6**, No. 44. Pp. 80.

* In those instances where references were cited in the literature but have not been available to the writer an * has been placed before the author's name. Those titles marked ‡ are abstracts of papers presented at scientific gatherings.

3. ALLEN, C., Some Experiments in Reinforcing Mental Analysis in Cases of Psychosis. *Brit. J. Med. Psychol.*, 1933, **13**, 151–164.
4. BABCOCK, H., An Experiment in the Measure of Mental Deterioration. *Arch. of Psychol.*, 1930, **18**, No. 117. Pp. 105.
5. ‡BABCOCK, H., Dementia Praecox—A Psychological Study. *Psychol. Bull.*, 1932, **29**, 567.
6. BABCOCK, H., *Dementia Praecox, a Psychological Study.* Lancaster, Pa.: Science Press Printing Co., 1933. Pp. 167.
7. BABCOCK, H., Psychological Testing in Psychopathology. *J. Appl. Psychol.*, 1931, **15**, 584–589.
8. BAIRD, J. W., Contraction of the Color Zones in Hysteria and Neurasthenia. *Psychol. Bull.*, 1906, **3**, 249–254.
9. BALL, R. J., An Objective Measure of Emotional Instability. *J. Appl. Psychol.*, 1929, **13**, 226–256.
10. BARNES, F. B., Some Aspects of Memory in the Insane. *Amer. J. Psychol.*, 1908, **19**, 43–57.
11. BARNES, G., A Comparison of the Results of Tests in the Terman Scale Between Cases of Manic-depressive and Dementia Praecox Psychoses. *J. Nerv. & Ment. Dis.*, 1924, **60**, 584–589.
12. BEBLE, G. L., A Study of Memory Deterioration in Encephalitis Lethargica. *J. Nerv. & Ment. Dis.*, 1925, **61**, 356–364.
13. BECK, S. J., The Rorschach Test in Problem Children. *Amer. J. Orthopsychiat.*, 1931, **1**, 501–509.
14. BECK, S. J., The Rorschach Method and Personality Organization. *Amer. J. Psychiat.*, 1933, **13**, 519–532.
15. BENDER, L., Principles of Gestalt in Copied Form in Mentally Defective and Schizophrenic Persons. *Arch. Neurol. & Psychiat.*, 1932, **27**, 661–686.
16. BENDER, L., Disturbances in Visuomotor Gestalt Function—In Organic Brain Disease Associated with Sensory Aphasia. *Arch. Neurol. & Psychiat.*, 1933, **30**, 514–537.
17. BENDER, L., and SCHILDER, P., Unconditioned and Conditioned Reactions to Pain in Schizophrenia. *Amer. J. Psychiat.*, 1930–1931, **10**, 365–384.
18. BERRIEN, F. K., Psychological Differences in Psychopathic and Post-encephalitic Children. *J. Appl. Psychol.*, 1934, **18**, 536–549.
19. BEVAN-LEWIS, W., *Text Book of Mental Diseases.* London: P. Blakiston's Son & Co., 1899. *Cf.* pp. 164, 364 and 365.
20. BINET, A., and SIMON, T. H., *The Intelligence of the Feeble-minded.* (Trans. by E. S. Kate.) Baltimore: The Williams & Wilkins Co., 1916. Pp. 327.
21. BLALOCK, J. R., Personality and Catatonic Dementia Praecox. *Psychiat. Quart.*, 1932, **6**, 625–640.
22. BOND, E. D., and ABBOT, E. S., A Comparison of the Personal Characteristics in Dementia Praecox and Manic-depressive Psychoses. *Amer. J. Insan.*, 1911–1912, **68**, 359–370.
23. BORING, E. G., Learning in Dementia Praecox. *Psychol. Monog.*, 1913, **15**, No. 63. Pp. 101.
24. *BORING, E. G., The Course and Character of Learning in Dementia Praecox. *Bull. Gov. Hosp. for Insane*, 1913, No. 5, 51–80.

25. Boring, E. G., Introspection in Dementia Praecox. *Amer. J. Psychol.*, 1913, **24**, 145–170.

26. Bowman, K. M., and Raymond, A. F., A Statistical Study of the Personality in Schizophrenic Patients. *Proc. Assoc. Res. Nerv. & Ment. Dis.—Schizophrenia*, 1931, **10**, 48–74.

27. Bowman, K. M., and Raymond, A. F., A Statistical Study of Delusions in the Manic-depressive Psychosis. *Amer. J. Psychiat.*, 1931–1932, **11**, 111–121.

28. Bowman, K. M., and Raymond, A. F., A Statistical Study of Hallucinations in the Manic-depressive Psychosis. *Amer. J. Psychiat.*, 1931–1932, **11**, 299–310.

29. Bromberg, W., and Schilder, P., On Tactile Imagination and Tactile After-Effects. *J. Nerv. & Ment. Dis.*, 1932, **76**, 1–24 and 133–155.

30. ‡Brown, A. W., A Quantitative Study of Some of the Intellectual and Emotional Changes Following Encephalitis Lethargica. *Psychol. Bull.*, 1934, **31**, 685–686.

31. Cameron, D. E., and Count, T. G. B., Studies in Perseveration. *J. Ment. Sci.*, 1933, **79**, 735–745.

32. Campbell, K. J., The Application of Extroversion-Introversion Tests to the Insane. *J. Abn. & Soc. Psychol.*, 1928–1929, **23**, 479–481.

33. ‡Chandler, C. M., Hand, Eye, and Foot Preference of Two Hundred Psychotic Patients and Two Hundred College Students. *Psychol. Bull.*, 1934, **31**, 593–594.

34. Couch, F. H., and Fox, J. C., Photographic Study of Ocular Movements in Mental Disease. *Arch. Neurol. & Psychiat.*, 1934, **31**, 556–578.

35. Coriat, I. H., Certain Pulse Reactions as a Measure of Emotions. *J. Abn. Psychol.*, 1909–1910, **4**, 261–279.

36. Cornell, E. L., and Lowden, G. L., A Comparison of the Stanford and Porteus Tests in Several Types of Social Inadequacy. *J. Abn. Psychol.*, 1923–1924, **18**, 33–42.

37. Curtis, J. N., Point Scale Examination on the High-Grade Feebleminded and the Insane. *J. Abn. Psychol.*, 1918–1919, **13**, 77–118.

38. Cutting, J. A., The Reaction of the Pupil to Colored Light. *J. Nerv. & Ment. Dis.*, 1917, **46**, 246–250.

39. Darrow, C. W., and Solomon, A. P., Galvanic Skin Reflex and Blood-Pressure Reactions in Psychotic States: Reactions to Sensory, Indifferent, Ideational, and Crucial Ideational Stimuli. *Arch. Neurol. & Psychiat.*, 1934, **32**, 273–299.

40. Dearborn, G. V. N., The Determination of Intellectual Regression and Progression. *Amer. J. Psychiat.*, 1926–1927, **6**, 725–741.

41. Dearborn, G. V. N., Intellectual Deterioration in Manic-depressive Psychosis. *U. S. Vet. Bur. Med. Bull.*, 1931, **7**, 388–392.

42. DeBruyn, J. W., A Study of Emotional Expression in Dementia Praecox. *J. Abn. Psychol.*, 1908–1909, **3**, 378–385.

43. Dodge, R., and Diefendorf, A. R., An Experimental Study of the Ocular Reactions of the Insane from Photographic Records. *Brain*, 1908, **31**, 451–489.

44. Dodge, R., and Fox, J. C., Optic Nystagmus: I. Technical Introduction with Observations in a Case with Central Scotoma in the Right Eye

and External Rectus Palsy in the Left Eye. *Arch. Neurol. & Psychiat.*, 1928, **20**, 812–823.

45. Dodge, R., Travis, R. C., and Fox, J. C., Optic Nystagmus: III. Characteristics of the Slow Phase. *Arch. Neurol. & Psychiat.*, 1930, **24**, 21–34.
46. Dorsey, J. M., and Travis, L. E., Reflex Response Latencies in Manic and Depressive Cases of the Cyclothymic Group and in Cases of Catatonic Stupor of the Schizophrenic Group. *Arch. Neurol. & Psychiat.*, 1932, **27**, 687–690.
47. DuBois, P. H., and Forbes, T. W., Studies of Catatonia, III. Bodily Postures Assumed While Sleeping. *Psychiat. Quart.*, 1934, **8**, 546–552.
48. DuBois, P. H., Mays, L. L., and Landis, C., Changes in Psychological Functions in Paresis, II. *Psychiat. Quart.*, 1934, **8**, 699–702.
49. Dysinger, D. W., An Action Current and Reflex Time Study of Psychiatric and Neurologic Cases. *Psychol. Monog.*, 1932, **43**, No. 194, 31–52.
50. Ewen, J. H., Perseveration in the Insane Epileptic. *J. Ment. Sci.*, 1930, **76**, 537–540.
51. Fearing, F. S., The Value of Psychological Tests in Psychiatric Diagnosis. *J. Abn. Psychol.*, 1919–1920, **14**, 190–196.
52. *Fearing, F. S., The Clinical Value of Psychological Tests in the Examination and Diagnosis of Mental Cases. *South. Med. J.*, 1919, **12**, 115–120.
53. Fetterman, J., and Barnes, M. R., Serial Study of Intelligence of Patients with Epilepsy. *Arch. Neurol. & Psychiat.*, 1934, **32**, 797–801.
54. Forbes, T. W., Studies of Catatonia, II. Central Control of Cerea Flexibilitas. *Psychiat. Quart.*, 1934, **8**, 538–545.
55. Forbes, T. W., and Piotrowski, Z. A., Studies of Catatonia, IV. Electrical Skin Resistance of Catatonics During Sleep. *Psychiat. Quart.*, 1934, **8**, 722–727.
56. Foster, J. C., Significant Responses in Certain Mental Tests. *J. Appl. Psychol.*, 1920, **4**, 142–154.
57. Fox, J. C., and Dodge, R., Optic Nystagmus: II. Variations in Nystagmographic Records of Eye Movements. *Arch. Neurol. & Psychiat.*, 1929, **22**, 55–74.
58. Franz, S. I., Anomalous Reaction-Times in a Case of Manic-depressive Depression. *Psychol. Bull.*, 1905, **2**, 225–232.
59. Franz, S. I., The Time of Some Mental Processes in the Retardation and Excitement of Insanity. *Amer. J. Psychol.*, 1906, **17**, 38–68.
60. Franz, S. I., The Knee-Jerk in Paresis. *Amer. J. Insan.*, 1908–1909, **65**, 471–498.
61. *Franz, S. I., Touch Sensations in Different Bodily Segments. *Gov. Hosp. Insane Bull.*, 1910, No. 2, 60–72.
62. Franz, S. I., and Hamilton, G. V., The Effects of Exercise upon the Retardation in Conditions of Depression. *Amer. J. Insan.*, 1905–1906, **62**, 239–256.
63. Gardner, G. E., The Measurement of the 'Psychotic Age'. Preliminary Report. *Amer. J. Psychiat.*, 1930–1931, **10**, 963–975.

64. GARDNER, G. E., Learning Ability of Schizophrenics. *Amer. J. Psychiat.*, 1931–1932, **11**, 247–252.

65. GATEWOOD, L. C., An Experimental Study of Dementia Praecox. *Psychol. Monog.*, 1909, **11**, No. 45. Pp. 87.

66. GAYLOR, J. B., and WISHART, G. M., The Metabolic Cost of Sustained Postures in Normal and Catatonic Subjects. *Brain*, 1933, **56**, 282–292.

67. GILLILAND, A. R., and MORGAN, J. J. B., An Objective Measure of Introversion-Extroversion. *J. Abn. & Soc. Psychol.*, 1931–1932, **26**, 296–303.

68. GOLLA, F. L., The Objective Study of Neurosis. *Lancet*, 1921, **2**, 215–221.

69. GORDON, A., Mental and Emotional Phenomena of Some Psychoses in Their Relation to Blood Pressure: Diagnostic and Prognostic Significance of Latter. *J. Nerv. & Ment. Dis.*, 1930, **72**, 396–404.

70. GRABFIELD, G. P., Variations in the Sensory Threshold for Faradic Stimulation in Psychopathic Subjects. First Note. *Boston Med. & Surg. J.*, 1914, **171**, 883–887.

71. GRABFIELD, G. P., Variations in the Sensory Threshold for Faradic Stimulation in Psychopathic Subjects, II. Manic Depressive Insanity. *Boston Med. & Surg. J.*, 1915, **173**, 198–202.

72. GRABFIELD, G. P., Variations in the Sensory Threshold for Faradic Stimulation in Psychopathic Subjects, III. The Dementia Praecox Group. *Boston Med. & Surg. J.*, 1915, **173**, 202–205.

73. GRABFIELD, G. P., Variations in the Sensory Threshold for Faradic Stimulation in Psychopathic Subjects. *J. Abn. Psychol.*, 1916–1917, **11**, 328–336.

74. HARRISON, F. M., The Rôle of Hallucinations in the Psychoses Based upon a Statistical Study of 514 Cases. *J. Nerv. & Ment. Dis.*, 1916, **43**, 231–249.

75. HART, B., and SPEARMAN, C., Mental Tests of Dementia. *J. Abn. Psychol.*, 1914–1915, **9**, 217–264.

76. HAUSMANN, M. F., A Test to Evaluate Some Personality Traits. *J. Gener. Psychol.*, 1933, **9**, 179–189.

77. HAUSMANN, M. F., A Method to Objectively Demonstrate Thinking Difficulties. *Amer. J. Psychiat.*, 1933–1934, **13**, 613–625.

78. HOCH, A., On Certain Studies with the Ergograph. *J. Nerv. & Ment. Dis.*, 1901, **28**, 620–628.

79. HOCH, A., Constitutional Factors in a Dementia Praecox Group. *Arch. Neurol. & Psychiat.*, 1910, **8**, 463–474.

80. *HOCH, A., Personality and Psychoses. *State Hosp. Bull.* (New Series), 1913, **6**, 220–230.

81. HOCH, A., A Review of Some Psychological and Physiological Experiments Done in Connection with the Study of Mental Diseases. *Psychol. Bull.*, 1904, **1**, 241–257.

82. HOLLINGWORTH, H. L., *Psychology of Functional Neuroses.* New York: D. Appleton & Co., 1920. Pp. 100–116.

83. HRDLIČKA, A., Contributions to General Etiology and Pathology of the Insane. *Amer. J. Insan.*, 1896–1897, **52**, 325–343.

84. HULL, C. L., The Formation and Retention of Associations Among the Insane. *Amer. J. Psychol.*, 1917, **28**, 419–435.

85. ‡HUNT, J. McV., Psychological Loss in Paresis and Schizophrenia. *Psychol. Bull.*, 1934, **31**, 713.

86. HUNT, J. McV., and GUILFORD, J. P., Fluctuation of an Ambiguous Figure in Dementia Praecox and in Manic-depressive Patients. *J. Abn. & Soc. Psychol.*, 1932–1933, **27**, 443–452.

87. ‡HUNT, W. A., The Conscious Correlates of the Galvanic Skin Response. *Psychol. Bull.*, 1934, **31**, 699.

88. HUNT, W. A., and LANDIS, C., Systematic Differences in Introspection. *Amer. J. Psychol.*, 1934, **46**, 659–660.

89. ‡HUSTON, P. E., Eye-Hand Coördination in Schizophrenic Patients and Normals as Measured by the Pursuitmeter. *Psychol. Bull.*, 1932, **29**, 662.

90. HUSTON, P. E., Sensory Threshold to Direct Current Stimulation in Schizophrenic and in Normal Subjects. *Arch. Neurol. & Psychiat.*, 1934, **31**, 590–596.

91. JACOBSON, E., *Progressive Relaxation.* Chicago: Univ. of Chicago Press, 1929. Pp. xiii+429.

92. JACOBSON, E., Electrical Measurements Concerning Muscular Contraction (Tonus) and the Cultivation of Relaxation in Man. Studies on Arm Flexors. *Amer. J. Physiol.*, 1934, **107**, 230–248.

93. JACOBSON, E., Electrical Measurements Concerning Muscular Contraction (Tonus) and the Cultivation of Relaxation in Man—Relaxation-Times of Individuals. *Amer. J. Physiol.*, 1934, **108**, 573–580.

94. JONES, L. W., An Investigation into the Significance of Perseveration. *J. Ment. Sci.*, 1928, **74**, 653–659.

95. JUNG, C. G., On Psychophysical Relations of the Associative Experiment. *J. Abn. Psychol.*, 1906–1907, **1**, 249–257.

96. JUNG, C. G., The Association Method. *Amer. J. Psychol.*, 1910, **21**, 219–269.

97. JUNG, C. G., *Studies in Word Association.* (Trans. by M. D. Eder.) New York: Moffat Yard, 1919. Pp. 575.

98. KASANIN, J., and ROSEN, Z. A., Clinical Variables in Schizoid Personalities. *Arch. Neurol. & Psychiat.*, 1933, **30**, 538–566.

99. KATZ, S. E., Color Preference in the Insane. *J. Abn. & Soc. Psychol.*, 1931–1932, **26**, 203–209.

100. ‡KATZ, S. E., Muscle Tonus in Psychotics. *Psychol. Bull.*, 1932, **29**, 662–663.

101. KENT, G. H., Experiments on Habit Formation in Dementia Praecox. *Psychol. Rev.*, 1911, **18**, 375–410.

102. KENT, G. H., An Experiment on the Instruction of Insane Subjects. *J. Nerv. & Ment. Dis.*, 1918, **48**, 313–324.

103. KENT, G. H., and ROSANOFF, A. J., A Study of Association in Insanity. *Amer. J. Insan.*, 1910–1911, **67**, 37–96.

104. LANDIS, C., Studies of Catatonia. I. Introduction. *Psychiat. Quart.*, 1934, **8**, 535–537.

105. LANDIS, C., and FORBES, T. W., An Investigation of Methods of Measurement of the Electrical Phenomena of the Skin. *Psychiat. Quart.*, 1933, **7**, 107–114.

106. LANDIS, C., and FORBES, T. W., Studies of Catatonia. VII. Conclusions and General Summary. *Psychiat. Quart.*, 1934, **8**, 745–747.

107. LANDIS, C., and RECHETNICK, J., Changes in Psychological Functions in Paresis. I. *Psychiat. Quart.*, 1934, **8**, 693–698.

108. LEVY, D. M., and BECK, S. J., The Rorschach Test in Manic-depressive Psychosis. *Manic-depressive Psychosis Publ. of Assoc. for Res. in Nerv. & Ment. Dis.*, 1931, **11**, 167–181.

109. LILJENCRANTS, J., Memory Defects in Organic Psychoses. *Psychol. Monog.*, 1922, **32**, No. 143. Pp. 76.

110. LIND, J. E., Statistical Study of Hallucinations in the Manic-depressive Type of Psychoses. *J. Nerv. & Ment. Dis.*, 1915, **42**, 727–735.

111. LOCKWOOD, M. R., A Parallel Study of the Psychogalvanic Reflex and the Hyperglycaemic Index in Psychotics. *J. Ment. Sci.*, 1932, **78**, 288–301.

112. LUNDHOLM, H., Reaction Time as an Indicator of Emotional Disturbances in Manic-depressive Psychoses. *J. Abn. Psychol.*, 1922–1923, **17**, 292–318.

113. MALAMUD, W., Dream Analysis, Its Application in Therapy and Research in Mental Diseases. *Arch. Neurol. & Psychiat.*, 1934, **31**, 356–372.

114. MALAMUD, W., and LINDER, F. E., Dreams and Their Relationship to Recent Impressions. *Arch. Neurol. & Psychiat.*, 1931, **25**, 1081–1099.

115. MALAMUD, W., and NYGARD, W. J., The Rôle Played by the Cutaneous Senses in Spatial Perceptions. II. Investigations in Mental Diseases. *J. Nerv. & Ment. Dis.*, 1931, **73**, 465–477.

116. MAYS, L. L., Studies of Catatonia. V. Perseverational Tendencies in Catatonic Patients. *Psychiat. Quart.*, 1934, **8**, 728–735.

117. MCCOWAN, P. K., The Physico-psycho-galvanic Reflex in the Neuroses and Psychoses. *J. Ment. Sci.*, 1926, **72**, 492–503.

118. MCDONALD, W., Mental Disease and Language. *J. Nerv. & Ment. Dis.*, 1915, **42**, 482–540.

119. MCFARLAND, R. A., The Relationship of Oxygen Want to Fatigue and Neurasthenia. *Psychol. Bull.*, 1932, **29**, 562–563.

120. MOORE, T. V., The Correlation Between Memory and Perception in the Presence of Diffuse Cortical Degeneration. *Psychol. Monog.*, 1919, **27**, No. 120. Pp. 46.

121. MOORE, T. V., Empirical Determination of Certain Syndromes Underlying Dementia Praecox and Manic-depressive Insanity. *Amer. J. Psychiat.*, 1929–1930, **9**, 719–738.

122. MURPHY, G., A Comparison of Manic-depressive and Dementia Praecox Cases by the Free-Association Method. *Amer. J. Insan.*, 1920–1921, **77**, 545–558.

123. MURPHY, G., Types of Word-Association in Dementia Praecox, Manic-Depressives, and Normal Persons. *Amer. J. Psychiat.*, 1922–1923, **2**, 539–571.

124. NEYMANN, C. A., and KOHLSTEDT, K. D., The Neymann-Kohlstedt New Diagnostic Test for Introversion-Extroversion. *J. Abn. & Soc. Psychol.*, 1928–1929, **23**, 482–487.

125. ÖDEGAARD, Ö., The Psychogalvanic Reactivity in Affective Disorders. *Brit. J. Med. Psychol.*, 1932, **12**, 132–150.

126. Olson, E., A Study of Emotions in Psychopathic Personalities. *J. Appl. Psychol.*, 1931, **15**, 182–198.

127. Osnato, M., Personality in Paresis. *J. Amer. Med. Assoc.*, 1918, **70**, 434–439.

128. Page, J., Landis, C., and Katz, S. E., Schizophrenic Traits in the Functional Psychoses and in Normal Individuals. *Amer. J. Psychiat.*, 1933–1934, **13**, 1213–1225.

129. Papurt, M. J., A Study of the Woodworth Psychoneurotic Inventory with Suggested Revision. *J. Abn. & Soc. Psychol.*, 1931–1932, **26**, 335–352.

130. Peterson, F., The Galvanometer as a Measurer of Emotions. *Brit. Med. J.*, 1907, **2**, 804–806.

131. Peterson, F., and Jung, C. G., Psycho-physical Investigations with the Galvanometer and Pneumograph in Normal and Insane Individuals. *Brain*, 1907, **30**, 153–218.

132. Piotrowski, Z. A., The Test Behavior of Schizophrenic Children. *Proc. Amer. Assoc. Ment. Def.*, 1933, **38**, 332–344.

133. ‡Piotrowski, Z. A., Work Habits as a Means of Differentiating Native and Acquired Deficiency. *Psychol. Bull.*, 1933, **30**, 728–729.

134. *Pollock, L. J., and Dallear, A. H., Pneumographic Studies of Emotional Reactions in Dementia Praecox. *Inst. Quart.*, Springfield, Ia., 1916, **7**, 73–78.

135. Porter, J. M., Galvanic Skin Phenomena in Epileptics. *J. Gener. Psychol.*, 1934, **11**, 24–45.

136. Pressey, S. L., Distinctive Features in Psychological Test Measurements Made upon Dementia Praecox and Chronic Alcoholic Patients. *J. Abn. Psychol.*, 1917–1918, **12**, 130–139.

137. Pressey, S. L., Irregularity on a Binet Examination as a Measure of Its Reliability. *Psychol. Clin.*, 1919, **12**, 236–240.

138. Pressey, S. L., and Cole, L. W., Irregularity in a Psychological Examination as a Measure of Mental Deterioration. *J. Abn. Psychol.*, 1918–1919, **13**, 285–294.

139. Prideaux, E., Expression of Emotions in Cases of Mental Disorder as Shown by the Psychogalvanic Reflex. *Brit. J. Med. Psychol.*, 1921–1922, **2**, 23–46.

140. Prince, M., Experiments to Determine Co-conscious (Subconscious) Ideation. *J. Abn. Psychol.*, 1908–1909, **3**, 33–42.

141. Prince, M., The Unconscious. *J. Abn. Psychol.*, 1908–1909, **3**, 335–353.

142. Prince, M., Evidence from Dormant Complexes Originating in States Other than the Personal Consciousness. *J. Abn. Psychol.*, 1909–1910, **4**, 36–56.

143. Prince, M., and Peterson, F., Experiments in Psychogalvanic Reactions from Co-conscious (Subconscious) Ideas in a Case of Multiple Personality. *J. Abn. Psychol.*, 1908–1909, **3**, 114–131.

144. Quinan, C., The Time and Lineage Factors of Hand Writing. An Experimental Study Based on Specimens Secured from 200 Normal Persons and from 148 Persons with Dementia Paralytica. *Arch. Neurol. & Psychiat.*, 1931, **26**, 333–345.

145. Rawlings, E., The Intellectual Status of Patients with Paranoid Dementia Praecox. *Arch. Neurol. & Psychiat.*, 1921, **5**, 283–295.

146. RICHMOND, W., Psychometric Tests in Essential Epilepsy. *J. Abn. Psychol.*, 1921–1922, **16**, 384–391.

147. RICHTER, C. P., Significances of the Changes in the Electrical Resistances of the Body During Sleep. *Proc. Nat'l Acad. Sci.*, 1926, **12**, 214–222.

148. RICHTER, C. P., A Study of the Electrical Skin Resistance and the Psychogalvanic Reflex in a Case of Unilateral Sweating. *Brain*, 1927, **50**, 216–235.

149. RICHTER, C. P., Electrical Skin Resistance. Diurnal and Daily Variation in Psychopathic and Normal Persons. *Arch. Neurol. & Psychiat.*, 1928, **19**, 488–508.

150. RICHTER, C. P., Pathologic Sleep and Similar Conditions Studied by the Electrical Skin Resistance Method. *Arch. Neurol. & Psychiat.*, 1929, **21**, 363–375.

151. ‡RICKERS-OVSIANKINA, M., A Study of the Behavior of Schizophrenics in a Free Situation. *Psychol. Bull.*, 1933, **30**, 740–741.

152. RICHSHER, C., and JUNG, C. G., Further Investigations on the Galvanic Phenomenon and Respiration in Normal and Insane Individuals. *J. Abn. Psychol.*, 1907–1908, **2**, 189–217.

153. RORSCHACH, H., The Application of the Interpretation of Form to Psychoanalysis. *J. Nerv. & Ment. Dis.*, 1924, **60**, 225–248 and 359–379.

154. ROSANOFF, A. J., MARTIN, H. E., and ROSANOFF, I. R., A Higher Scale of Mental Measurement and Its Application to Cases of Insanity. *Psychol. Monog.*, 1918, **25**, No. 109. Pp. 113.

155. SAUNDERS, E. B., and ISAACS, S., Tests of Reaction-Time and Motor Inhibition in the Psychoses. *Amer. J. Psychiat.*, 1929–1930, **9**, 79–112.

156. SCHILDER, P., Experiments on After-Images, Imagination and Hallucinations. *Amer. J. Psychiat.*, 1933–1934, **13**, 597–611.

157. SCHOTT, E. L., Superior Intelligence in Patients with Nervous and Mental Disease. *J. Abn. & Soc. Psychol.*, 1931–1932, **26**, 94–101.

158. SCHWARZ, R., Measurement of Mental Deterioration in Dementia Praecox. *Amer. J. Psychiat.*, 1932–1933, **12**, 555–562.

159. SCRIPTURE, E. W., Reaction Time in Nervous and Mental Diseases. *J. Ment. Sci.*, 1916, **62**, 698–719.

160. ‡SHAKOW, D., A Study of Certain Aspects of Motor Coördination in Schizophrenia with the Prodmeter. *Psychol. Bull.*, 1932, **29**, 661.

161. SHIPLEY, W. C., Studies of Catatonia. VI. Further Investigation of the Perseverational Tendency. *Psychiat. Quart.*, 1934, **8**, 736–744.

162. SIMS, V. M., Variability of I.Q.'s for Psychopaths Compared with Normal Children. *Psychol. Clin.*, 1930, **19**, 26–31.

163. SIMMINS, C., Studies in Experimental Psychiatry. IV. Deterioration of '*g*' in Psychotic Patients. *J. Ment. Sci.*, 1933, **79**, 704–734.

164. SMITH, H. N., A Study of the Neurotic Tendencies Shown in Dementia Praecox and Manic-depressive Insanity. *J. Soc. Psychol.*, 1933, **4**, 116–128.

165. SMITH, W. A., A Comparison of Some Mental and Physical Tests in Their Application to Epileptic and to Normal Subjects. *Brit. J. Psychol.*, 1904, **1**, 240–260.

166. SOLOMON, A. P., and FENTRESS, T. L., Galvanic Skin Reflex and Blood Pressure Reactions in the Psychoneuroses. *J. Nerv. & Ment. Dis.*, 1934, **80**, 163–182.

167. STEPHENSON, W., Studies in Experimental Psychiatry: I. A Case of General Inertia. *J. Ment. Sci.*, 1931, **77**, 723–741.

168. STEPHENSON, W., Studies in Experimental Psychiatry: II. Some Contact of the *P*-Factor with Psychiatry. *J. Ment. Sci.*, 1932, **78**, 315–330.

169. STEPHENSON, W., Studies in Experimental Psychiatry: III. *P*-Score and Inhibition for High *P* in Praecox Cases. *J. Ment. Sci.*, 1932, **78**, 908–928.

170. STREET, R. F., The Gestalt Completion Test and Mental Disorder. *J. Abn. & Soc. Psychol.*, 1934–1935, **29**, 141–142.

171. STRONG, E. K., A Comparison Between Experimental Data and Clinical Results in Manic-depressive Insanity. *Amer. J. Psychol.*, 1913, **24**, 66–98.

172. SYZ, H. C., Psychogalvanic Studies in Schizophrenia. *Arch. Neurol. & Psychiat.*, 1926, **16**, 747–760.

173. SYZ, H. C., Psychogalvanic Studies in Schizophrenia. *Proc. Assoc. for Res. in Nerv. & Ment. Dis.*, 1928, **5**, 292–309.

174. SYZ, H. C., and KINDER, E. F., Electrical Skin Resistance in Normal and in Psychotic Subjects. *Arch. Neurol. & Psychiat.*, 1928, **19**, 1026–1035.

175. SYZ, H. C., and KINDER, E. F., The Galvanic Skin Reflex. Further Aspects in Psychopathological Groups. *Arch. Neurol. & Psychiat.*, 1931, **26**, 146–155.

176. TENDLER, A. D., The Mental Status of Psychoneurotics. *Arch. of Psychol.*, 1923, **9**, No. 60. Pp. 86.

177. TENDLER, A. D., Associative Tendencies in Psychoneurotics. *Psychol. Clin.*, 1933, **22**, 108–116.

178. TRAVIS, L. E., Suggestibility and Negativism as Measured by Auditory Threshold During Reverie. *J. Abn. Psychol.*, 1924–1925, **19**, 283–298.

179. TRAVIS, L. E., A Test for Distinguishing Between Schizophrenoses and Psychoneuroses. *J. Abn. Psychol.*, 1924–1925, **19**, 283–298.

180. TRAVIS, L. E., Rate of Reflex Conduction in a Cataleptic Patient. *Proc. Soc. Exper. Biol. & Med.*, 1928, **25**, 598–599.

181. TRAVIS, L. E., and DORSEY, J. M., Patellar Tendon Reflex Time in Psychiatric and in Neurologic Cases. *Arch. Neurol. & Psychiat.*, 1929, **22**, 99–104.

182. TRAVIS, R. C., The Diagnosis of Character Types by Visual and Auditory Thresholds. *Psychol. Monog.*, 1926, **36**, No. 168, 18–37.

183. WALLIN, J. E. W., Scattering in the Binet Scale. *J. Appl. Psychol.*, 1927, **11**, 142–154.

184. WECHSLER, D., *A Study of Retention in Korsakoff's Psychosis.* Thesis, Dept. of Psychol., Columbia University, 1917.

185. WELLS, F. L., Studies in Retardation: As Given in the Fatigue Phenomena of Tapping Test. *Amer. J. Psychol.*, 1909, **20**, 38–59.

186. WELLS, F. L., Motor Retardation as a Manic-depressive Symptom. *Amer. J. Insan.*, 1909–1910, **66**, 1–52.

187. WELLS, F. L., Some Properties of the Free Association Time. *Psychol. Rev.*, 1911, **18**, 229–233.

188. WELLS, F. L., Psychotic Performances in Cancellation and Directions Tests. *Psychol. Rev.*, 1919, **26**, 366–371.

189. WELLS, F. L., Autistic Mechanisms in Association Reaction. *Psychol. Rev.*, 1919, **26**, 376–381.

190. WELLS, F. L., *Mental Tests in Clinical Practice.* New York: World Book Co., 1927.

191. WELLS, F. L., Learning Functions in an Obscure Amnesia with Implications for Re-Education. *J. Gener. Psychol.*, 1933, **8**, 175–197.

192. WELLS, F. L., Experimental Pathology of the Higher Mental Processes. *Psychol. Bull.*, 1913, **10**, 213–224.

193. WELLS, F. L., Experimental Psychopathology. *Psychol. Bull.*, 1914, **11**, 202–212.

194. WELLS, F. L., and CURRIE, J. P., Time Factors in the Substitution Test with Psychotic Cases. *J. Abn. Psychol.*, 1922–1923, **17**, 402–404.

195. WELLS, F. L., and FORBES, A., On Certain Electrical Processes in the Human Body and Their Relation to Emotional Reactions. *Arch. of Psychol.*, 1908–1911, **2**, No. 16. Pp. 39.

196. WELLS, F. L., and KELLEY, C. M., Intelligence and Psychosis. *Amer. J. Insan.*, 1920–1921, **77**, 17–45.

197. WELLS, F. L., and KELLEY, C. M., The Simple Reaction in Psychosis. *Amer. J. Psychiat.*, 1922–1923, **2**, 53–59.

198. WELLS, F. L., and MARTIN, H. A., A Method of Memory Examination Suitable for Psychotic Cases. *Amer. J. Psychiat.*, 1923–1924, **3**, 243–258.

199. WELLS, F. L., and STURGIS, H. A., The Pathology of Choice Reactions. *Amer. J. Insan.*, 1918–1919, **75**, 81–119.

200. WENTWORTH, M. M., Two Hundred Cases of Dementia Praecox Tested by the Stanford Revision. *J. Abn. Psychol.*, 1923–1924, **18**, 378–384.

201. WESTBURGH, E. M., Psychogalvanic Studies on Affective Variations in the Mentally Diseased. *Arch. Neurol. & Psychiat.*, 1929, **22**, 719–736.

202. WESTBURGH, E. M., and EYMAN, E. V., Psychogalvanic Studies on Affectivity of Manic-depressive Patients. *Proc. Assoc. Res. in Nerv. & Ment. Dis.*, 1931, **11**, 237–258.

203. WILLIAMS, G. W., A Study of the Responses of Three Psychotic Groups to a Test of Suggestibility. *J. Gener. Psychol.*, 1932, **7**, 302–309.

204. WIRES, E. M., Interpretation of Reactions to Pintner-Patterson Performance Scale. *J. Educ. Res.*, 1931, **24**, 53–57.

205. WITTMAN, P., The Babcock Deterioration Test in State Hospital Practice. *J. Abn. & Soc. Psychol.*, 1933–1934, **28**, 70–84.

206. *WITMER, H. L., *et al.*, The Childhood Personality and Parent-Child Relationships of Dementia Praecox and Manic-depressive Patients. *Smith Coll. Stud. Soc. Work*, 1934, **4**, 289–377.

207. WYLIE, M., An Experimental Study of Recognition and Recall in Abnormal Mental Cases. *Psychol. Monog.*, 1930, **39**, No. 180. Pp. 81.

208. YERKES, R. M., Use of the Binet Method in Hospitals for the Insane. *Mass. Comm. Ment. Dis. Bull.*, 1917, **1**, 58–65.

209. ‡YU, P. E., A Personality (Bernreuter) Study of Two Groups of Psychotics. *Psychol. Bull.*, 1934, **31**, 586–587.

210. ‡ZUBIN, J., The Determination of Response-Patterns in Personality Inventories. *Psychol. Bull.*, 1934, **31**, 714.

SPECIAL REVIEW

KOFFKA'S PRINCIPLES OF GESTALT PSYCHOLOGY [1]

BY EDWIN G. BORING
Harvard University

At last we have a thorough, complete, systematic, representative Gestalt psychology! For 15 years this vigorous, influential, philosophical and experimental movement has been represented by a large experimental literature, by the scattered writings of its chief proponents, or by the less authentic expositions of outsiders or late converts. There is a tradition that the test of a school of psychology lies in its capacity to produce a systematic text which exhibits the adequacy and advantages of its special point of view throughout the range of psychology. Wundt, Brentano, the early Külpe, James, Titchener, and Watson met this test. Stumpf, Müller, the Külpe of Würzburg, and Angell never did, and their influence on psychology has been less because their views as applied to many topics remained indeterminate. Therefore, we owe Koffka a debt of gratitude because he, as one of three men competent to speak authoritatively of Gestalt psychology, has exhumed from a mass of literature the proper bones and put them together so as to show the nature of the Gestalt creature by the exhibition of a complete skeleton.

The book is large and difficult, but it is also erudite and urbane. To read it understandingly is a formidable task for one who is not already well habituated to at least some of its concepts. On the other hand, reading yields the reward of an arduous adventure. The action of the book takes place entirely within a special world of psychological things, and this for most of us is a strange new land. Heretofore psychology has had the common dualism of actual experience and 'physical objects'. It has also had the common monism of the so-called physical world, adjusted to include psychology because neural and behavioral events can be regarded as physical. It has also talked about 'reals' being 'constructs', with the implication that psychology might have its own special world of proper constructs; and particular constructs, like the *unconscious* and the *trace*, have

[1] Koffka, K., *Principles of Gestalt Psychology*. New York: Harcourt, Brace and Company, 1935. Pp. xi+720.

sometimes emerged. However, I have never before read a completed system that created and kept consistently within such a special world. There may be such systems, and perhaps psychoanalysis provides one. In any case the Gestalt world is a new world and, in Koffka's care, almost a self-sustaining one. The creation of such a system of constructs and the maintenance of the exposition within the system is no mean achievement, and I do homage to the psychology and the author that have accomplished this feat.

No abstract is possible of a book so replete with information, so novel in its approach, so strange in its selection of minutiae, so valiant and meticulous in its polemizing, so scrupulous in its logic, and so interminably perverse to tradition. It is no wonder that the book is difficult, although Koffka's persistent candor in exposing (and in general repairing) the clefts in his armour is refreshing. Let us indicate the general scope and nature of the text before we plunge bravely into the war that Koffka wages.

It is possible to regard the book as constituted of four parts: (1) the general argument establishing the fundamental concepts (103 pp.), (2) visual perception (200 pp.), (3) action (117 pp.), and (4) memory, learning, recognizing, and thinking (225 pp.). There are also a short and admittedly inadequate chapter on society and personality (32 pp.), a conclusion (6 pp.), a bibliography (345 titles, of which 76 are from *Psychologische Forschung*), and a large index (18 pp.).

The first part selects the field of battle and 'digs in'. Psychology has the cultural advantage of combining the study of *nature, life,* and *meaning,* that is to say, it deals with *quantification, organization,* and *signification.* Organization (order) is a subject-matter because psychology undertakes to determine the laws of dynamical interaction between things and events in the psychological *field.* Thus the psychologist is always considering totalities (Gestalten) which are *molar* (not molecular). However, signification (significance, meaning) is just as fundamental in the psychological data as in their organization. The individual organizes its environment into *things* and things into larger structures, and the concept *thing* carries all the implication and significance of a meaning. The facts of perceptual constancy support this view, because then an organism is found recreating and maintaining a thing, which has not been maintained in the proximal stimulation at the sense-organ, but which has been recreated by the laws of organization that belong to the organism itself.

The material of psychology, Koffka holds, is *molar behavior.*

Dynamical organization occurs within the behavioral environment, and the *behavioral environment* is the environment as it is to the individual—not what we might call the 'real' or 'physical' environment or what Koffka calls the "geographical" environment. This view sounds like what we are accustomed to call a behaviorism, until we are confronted by the fact that this behavior is intrinsically meaning. If a rat runs toward food in a food-box, the food is there in the behavioral environment. It is irrelevant that the experimenter has removed the 'real' food from the 'geographical' food-box. If I walk across the thin ice of a snow-covered frozen lake and 'think' (as the layman would say) that I am walking across a field, then there is a field in my behavioral environment and no lake. Such a "behavioral object" as this field takes the place of the perceptual objects of a simple dualism, and the word *behavioral* occurs throughout the text where the naïve writer would have written *conscious*.

The chapters on *visual perception* form distinctly the ablest portion of the book. In them the reader penetrates into the special psychological world with its atmosphere of meaning. It is possible for Koffka chiefly to present facts that are derived from experiments and thus to provide empirical validation of his concepts. He shows us that primitively the visual field is not even organized into units, but that organization yields *units* and, at higher levels, *shapes, lines* and *points*. The point—the molecule of a Wundtian perception—is the result of a high degree of organization. *Figure* and *ground* are a type of "duo organization". The one is thing; the other is framework. *Contours* bound the figure but not the ground, for the ground is continuous behind the figure. One perceives the table beneath the book which lies upon it. Wundt's book would have filled a hole in the table, but not Koffka's. The constancies of shape, size, whiteness, and color show the organism maintaining things in the face of variation of proximal stimulation. When one knows what it is that is *invariant* when these aspects of behavioral objects are constant in spite of varying stimulation, then one knows the law of the perception in question. Visual space is *anisotropic:* no free transposition of extensions in space without change of size or shape is possible. The facts of the visual perception of movement and velocity support this conception.

The chapters on *action* dismiss as molecular the reflex and the stimulus-response concepts. They introduce the *Ego,* which is a variable thing, expanding now to include its clothes, its country and its ideals, and contracting again to exclude even its hand. The "bound-

ary membrane" of the Ego is determined by the way in which the Ego as a behavioral object enters into reaction with other behavioral objects in the psychological field. The *Executive* (Lewin's *Motorik*) is derived from the Ego and aims at a relief of stress which may or may not result directly in action. In understanding these dynamical systems we have to realize that things have *demand characters,* which they have acquired in the process of their organization, and also *physiognomic characters,* which appear in their initial organization. The newly hatched chick pecks at small grains because of their physiognomic character, but I buy Koffka's book because of its demand character. The chief problem of action is the adjustment of behavior, whereby the individual becomes adequate to his world. Thus we may revive the old concept of *attitude* as a general adjustment to the field, and the concept of *attention* as a specific adjustment to the field. *Emotion* and *will* are not really special psychological chapters, but terms which focus interest upon particular systems of behavioral adjustment. Koffka rejects the classification of emotion as futile and the physiology of emotion as irrelevant, and deals instead with the dynamics of "saturation" and subsequent "explosion". There are not yet many experiments extant to support the content of this section.

The last four chapters might be put under two headings: (1) Traces and (2) The Communication of Traces. The concept of the *trace* is needed to account for the continuity of behavior. Koffka thinks isomorphically of the trace as a neural condition in the brain, but he could regard it as a psychological construct for all he gains by his physiology. The laws of the trace emerge from the experiments on *successive comparison.* Traces persist. Traces from the repetition of a given process pile up "in columns". Such persisting traces interact dynamically and undergo change, provided they *communicate* with one another. *Memory* implies communication between a process and a trace. *Forgetting* is usually due to lack of communication. *Learning* is simply the leaving of a trace by a process, but the acquisition of skill implies that the deposited traces have interacted cumulatively and left a new resultant. Associative learning is simply a kind of associative reorganization of traces (the molecular nonsense syllable has been excommunicated from psychology), and, since organization is dynamic, association can thus be regarded as a force. *Recognition* requires that a process should communicate with a trace, and the peculiar Me-ness (feeling of familiarity) of recognition is due to the communication of the trace with the Ego-object trace. *Think-*

ing solves problems by reorganizing traces by means of their communications, and the *law of effect* means that success acts upon the organization of traces. The experiments cited here are mostly from Koffka's or Lewin's students, and the dead hand of Ebbinghaus no longer throttles these problems.

This scant synopsis can at least whet the reader's curiosity about Koffka's book. It also delineates the universe within which our further discussion must take place. Having placed on record my admiration for this thorough, erudite, sophisticated, original, systematic treatise, I wish now to devote the remainder of this review to a criticism of Koffka for his failure to give adequate definition to his basic concepts. Let me attack his system in this way and let the reader estimate my success.

The span of Koffka's systematic structure rests upon two pedestals. Let us call them *organization* and *meaning*. *Organization* is the Gestalt principle that a large dynamic system is more than the sum of its parts and that such systems are the rule among psychological phenomena. This principle is the great contribution of Gestalt psychology and I think that no one—certainly no one who has read this book—will any longer attempt to displace it. *Meaning* is the principle that a psychological object has signification (significance, implication, intentionality) as part of its essence. This principle is not an accepted fact and dispute about it is bound to arise. In such cases, I think, we must demand rigid definition.

Here we must pause to ask what a definition is and why we have a right to insist upon one in such a case. In the old days scientific disputants could go back to immediate experience. The theory then was that experience cannot lie, that there must always be agreement if factual dubiety can be reduced to the basic givens. That was positivism, which Koffka deplores and I can do without. However, we have now a more modern panacea for disagreement. Disputation nearly always arises because some extra attribute or property has got itself introduced into the 'reals' in the process of reification or conceptualization. The technique by which understanding and agreement are got lies in defining the things and concepts in terms of the scientific operations by which they are known. I think that Koffka does not accept this operational procedure. He said of Tolman in 1933: "I do not agree with him that these criteria can at the same time serve as definitions, provided we are not dealing with mere fictions" (*Psychol. Bull.*, 1933, **30**, 443, *q.v.*). It is plain to me from Koffka's book that he believes firmly in the immediate intuition of scientific

things and that there lies the reason why he thinks that operational definitions apply only to 'fictitious' concepts. However, to me it seems that this very book is the best possible argument against the validity of such intuition, for with all his care and pains Koffka is still unable to impart to me many of his intuitions about psychological things. It is thus that I find my sanction for bringing what is essentially external criticism to bear against him, by asking for definition and insisting that I know no safe definition in science that is not operational. If Koffka knows of another way out of this dilemma of disagreement, the burden lies upon him to show it. I think there is none.

Let us now return to the problem of the meaning which is intrinsic in every "behavioral object", and do our best to understand what Koffka says about it. Let us take the case of the continuity of the ground behind the figure (*cf.* pp. 178–181). Can we see the table beneath the book which lies upon it, or does the book interrupt the table? Koffka says that we can see the table as continuous. It is a case of "double representation" in the sense that we see two things at different distances in the same part of the bidimensional field. The book is, as it were, transparent, and the table is seen through it. It is true, he adds, that the table at this region is colorless, but then so is the phi-phenomenon in perceived movement. As soon as we get over thinking that we cannot see a thing unless it is black, gray, white or some hue, we shall have no trouble in perceiving the table beneath the book.

Koffka admits the existence of alternative points of view in this case. He imagines counsel confounding a witness who has sworn that he saw the table through the book, and notes that "what the counsel means by seeing is not the same as what we mean by it" (p. 180). So that is the point. *What* does Koffka mean by seeing? Not what Titchener meant. Not sensory phenomenon characterized by quality, extension, and the other traditional attributes. He means that the witness knows that the table is there, and that knowing and perceiving are not different. Knowing is in such a case not a conscious or unconscious inference; plenty of evidence can be marshalled to show that the knowing is too immediate for that. We simply perceive the table as continuous.

Now there is no use in this case of going back to the Titchenerian alternative. Koffka admits it as a possible point of view, but, although it may still have uses in psychology, I do not want to champion the concept of immediate experience in its traditional sense. Moreover,

Koffka has put us in the presence of a fact: we do know at once that the table is behind the book. He asks us to espouse a psychology that can take account of such a fact. What are we to do?

Obviously we must go with him. A fact is a fact. However, I think, we must also go far beyond him. We have here as a behavioral object a table, which is continuous, even though in the 'real' table some psychologist may have cut a hole beneath the book. We simply must have a definition of a behavioral object.

It seems pretty clear that the meaning which belongs to a behavioral object is some sort of *knowledge*. However, to identify knowledge with meaning is not to define either, for knowledge is a notoriously equivocal concept. Knowledge may be actual in the sense that it determines some present functional relation. Or it may be potential in that it would enter into some relation if other terms were given. It may be conscious in the sense that it is an object of observation to the person who has it. Or it may be unconscious in the sense that it is an object of observation only to some other person or is the result of scientific inference. It is in the face of such equivocality that a definition may rightfully be demanded, and I insist that there is nothing for us to do but to go to the operations by way of which such 'knowledge' becomes known.

Scientific insight, of course, comes first from instances, although we have to transcend the instances to gain a definition. If we want to know what exactly is a behavioral object, we must inquire concerning the nature of the evidence that the object exists in a given instance (*e.g.* for the table as ground) and in all other instances. How do we know that a person sees the table as continuous? Because he acts as if it were continuous. How do we know that the man sees the snow-covered frozen lake as a snow-covered field? Because he acts as if it were a field. How do I know that I saw the lake as a field? Because I acted in movement and in emotion as if it were a field. How do I know that this red and this green look alike to you who are color-blind? Because you say they are alike. We define the object by its effects.

As we have seen, Koffka believes in the immediate intuition (my phrase; he has none) of a behavioral object. That is, however, a retreat to immediate experience as the final common ground. We ought not to be offered this technique by the chief opponents of those who used it (from Wundt to Titchener) and who found that they could not compel agreement by it. All through this book I have been puzzled by what seems to me to be a persistent contradiction:

Koffka's explicit avoidance of *immediate experience* and his implicit dependence upon it as the ultimate. Has he not perhaps repressed *immediate experience* because he hates positivism, therefore admitting it only in disguise?

At this point of the argument Koffka seems to me to have a choice. He may come out frankly and embrace immediate experience as the ultimate court of appeal. Then I say to him that I am not satisfied. The verdict of immediate experience has never been clear. Koffka remembers Würzburg. The *unanschauliche Bewusstheit* came to the world out of immediate experience. Is it in his book? On the other hand, he may repudiate the appeal to immediate experience and what he said to Tolman, perhaps too rashly, in 1933. He may accept our argument and wish to go along with us. Where shall we take him?

It would be kind if we could keep him in the land of undefined behavioral objects, but I see no way to do it. If the operational path is the only one open to us, then we shall find ourselves soon concerned with that behavior of organisms which indicates the existence of the behavioral object, and which provides the defining criteria of it. It does not bother me that the behavioral object may thus appear to him to be a " fiction ". Science is the great cultural artifact and its ' reals ' are fictions. Koffka himself is at pains to show that a *thing* is *made* and not given. This matter seems to me to be so commonly understood that I shall not stop to argue the point. We must take the behavioral object as defined by its criteria, else it is meaningless.

However, the criteria are the data of the observation—of the experiment when the observation is controlled. Such things exist for the observer and the experimenter and they belong to the " geographical " environment. Thus from Koffka's esoteric world of psychological things we emerge upon the familiar ground of the real world, and Koffka's special ' behavioralism ' becomes a common behaviorism. Most persons will say that in it we deal with real, common-sense objects, but—whether they are right or whether they are wrong—our criteria are identical in nature with the criteria that the physicist uses to define his concepts. We are no longer in a special world, and we have mastered the mystery of meaning by requiring a definition of it.

Thus I am ready to go all the way with Koffka if he will go all the way with me. No one knows so well as he how changed his system will be if he accepts my invitation.

It has been worth our while to argue the case of meaning at

length, first, because meaning is a corner-stone of this systematic structure and insecurity there affects the entire edifice, and, secondly, because the argument serves as the type of criticism that can be directed against other concepts. Let us consider briefly three other concepts.

The first of these concepts is the *demand character*. What is a demand character? Since I cannot find a definition in Koffka, I venture this on his behalf: A demand character is that property of a field object by virtue of which it attracts or repels an individual. I think that this is exactly what Koffka means, and I note with pleasure that the definition is operational and that the demand character is just as much of a fiction as other scientific 'reals'. However, I think that Koffka has betrayed his own genius in attempting to localize the demand character in the object. He discusses the question as to whether the demand character in the object is identical with the need in the individual (pp. 345f., 355ff.), and he localizes the force in the object, because objects have certain properties, like movement, which compel attention. However, I think that, if Koffka had undertaken to define a demand character, to establish its criteria, he would have discovered that what he is considering is a property of the larger dynamic system that includes both the field object and the Ego. That is the lesson of Gestalt psychology, that properties can apply to systems, and we have here a property of a dynamic relation between a field object and the individual. That Koffka fails to eat the bread of his own baking is due, I suggest, to the fact that he is not yet weaned from immediate experience.

(Here I must digress briefly to say that operational definition is a process that has no logical end, but an actual end in scientific agreement. If Koffka says of my definition of the demand character that the word *attract* requires definition, I should cheerfully comply. A call for definition is *ipso facto* a need for it. But this regress is not in practice infinite. It stops in the face of agreement, and the scientist never is confronted with the problem of defining the meaning of every word without the use of words.)

The most important concept for the intellectual and memorial processes is the *trace*. In this case the operational definition is clear, because the trace is defined by the events of the exact experiments on successive comparison. The concept of trace can therefore readily be made to meet my requirements, although, of course, Koffka is not trying thus to define it. Instead he appeals to isomorphism—the only place in the entire book where he makes serious use of this concept

which he introduced in Chapter 2—and he localizes the trace in the brain. Why should he do this since he can offer no operations to prove that the trace is neural? There is no more reason for his appealing to isomorphism here than anywhere else. His vague speculations about the neural basis of the trace do not help the argument, and the trace is quite self-sustaining without the brain. He has placed a weak neural prop against a sturdy conceptual structure. Again I think the cause must lie in his need to reify the truly fictional trace as he reified the demand character.

The concept of *communication* between traces is not so happy as the concept of trace. It is the crucial concept in the discussion of learning, forgetting, recognizing, and thinking. Traces communicate when they affect each other, entering into a reorganization. Sometimes they do not communicate. If we could say when they communicate and when they do not, we should probably have the data for an operational definition. Koffka's appeal to similarity as the cause of communication (pp. 598ff.) will not suffice, for, of all the concepts which the psychologist uses, *similarity* is probably the one most in need of operational definition and least capable of entering into a convincing argument when it lacks such definition. The consequence is that most of this latter discussion in the book seems to me very little more than an elaborate and sophisticated juggling of words. I cannot pin the argument down to empirical fact, not even by way of Harrower's excellent experiments. We need, I think, to know something about an invariant of communication before we know what communication is.

My notes call for the discussion of the concepts *molar, isomorphism, unit, shape, anisotropy, Ego,* and *similarity.* The list could be trebled and still include no trivial concept. However, space and the reader's patience must be growing short together. A thorough review of so thorough a book is impossible; and the reviewer must be content to choose this and that according to his insight of the moment, say his say, and stop.

What my criticism comes to is this. I think that Koffka is on one of the two best roads toward psychology's goal. The other road leads the physiological psychologists through the "geographical environment". Koffka's path through the "behavioral environment" has its culs-de-sac and I have shown where I think some of them are. He needs, I have argued, not to go back, but to go farther; and I have ventured the prediction that, if he keeps on under the drive of his superb determination to be rigorous, he will walk right out of

the behavioral environment into the region where there are no *a priori* meanings and all scientists travel together, amply sustained by their fabricated conceptions.

Thus it appears that Gestalt psychology, as Koffka presents it, must be peculiarly transitory because we can already see beyond it. The ultimate test of a system must be its *univocality*. The pragmatic test, upon which, I suspect, Koffka relies, will not serve, for any self-consistent system seems to work when one gets habituated to its use, until an outsider does to it what the Gestalt psychologists have done to the Wundtians. A system whose terms can, on call, be rigidly defined has the most certain chance of a long life, and in this respect Gestalt psychology has great need to alter its complexion.

BOOKS RECEIVED

BENTLEY, A. F., *Behavior, Knowledge, Fact.* Bloomington, Indiana: The Principia Press, Inc., 1935. Pp. xii+391.

BRUNSWIK, EGON, *Experimentelle Psychologie in Demonstrationen.* Wien: Julius Springer, 1935. Pp. x+166.

CRAWLEY, S. L., *Study Outline for General Psychology.* New York: Prentice-Hall, Inc., 1935. Pp. ix+223.

DEWEY, E., *Behavior Development in Infants.* New York: Columbia University Press, 1935. Pp. viii+321.

DOLLARD, J., *Criteria for the Life History.* New Haven: Yale University Press, 1935. Pp. v+288.

FINNER, P. F., *An Introduction to Experimental Psychology.* New York: Prentice-Hall, Inc., 1935. Pp. xiii+268.

FREUD, S., *An Autobiographical Study.* London: The Hogarth Press, 52 Tavistock Square, 1935. Pp. 137.

GATES, A. I., *Generalization and Transfer in Spelling.* New York: Bureau of Publications, Teachers College, Columbia University, 1935. Pp. vi+80.

GRAY, J. S., *Psychological Foundations of Education.* New York: American Book Company, 1935. Pp. xiii+534.

KARPMAN, B., *The Individual Criminal: Studies in the Psychogenetics of Crime* (Vol. I). Washington: Nervous and Mental Disease Publishing Company, 1935. Pp. x+317+2 charts.

PEILLAUBE, E., *Caractère et personnalité.* Paris: Pierre Téqui, 82 Rue Bonaparte, 1935. Pp. viii+222.

PERRY, R. B., *The Thought and Character of William James* (Two Volumes). Boston: Little, Brown, and Company, 1935. Pp. xxxviii+826 and xxii+786.

STERN, W., *Allgemeine Psychologie auf Personalistischer Grundlage* (Vol. II). The Hague: Martinus Nijhoff, 1935. Pp. 367–831+xxviii.

VALENTINE, W. L., TAYLOR, J. H., BAKER, K. H., and STANTON, F. N., *Student's Guide for Beginning the Study of Psychology.* New York: Prentice-Hall, Inc., 1935. Pp. vii+267.

WALLIN, J. E. W., *Personality Maladjustments and Mental Hygiene.* New York: McGraw-Hill Book Company, 1935. Pp. xii+511.

WARDEN, C. J., JENKINS, T. N., and WARNER, L. H., *Comparative Psychology. Vol. I: Principles and Methods.* New York: The Ronald Press Company, 1935. Pp. x+506.

WEISENBURG, T., and MCBRIDE, K. E., *Aphasia: A Clinical and Psychological Study.* New York: The Commonwealth Fund, 1935. Pp. xvi+634.